The Woodworker's Journal
Vol. 16, No. 5

New Lathe Technique:
Vacuum Turning
Make yo-yo's, trivets, pocket mirrors and more with our low-cost Shop-built Vacuum Chuck

Tool Review:
Benchtop Table Saws
- Amps vs. Horsepower
- Super Table Saw Jig
- An Introduction to Chairbuilding

Plans: Step Stool/Chair • Pine Hutch
ıycenter • Acrobatic Bear Folk Toy
astic Bag Handle • Child's Windsor

September/October 1992

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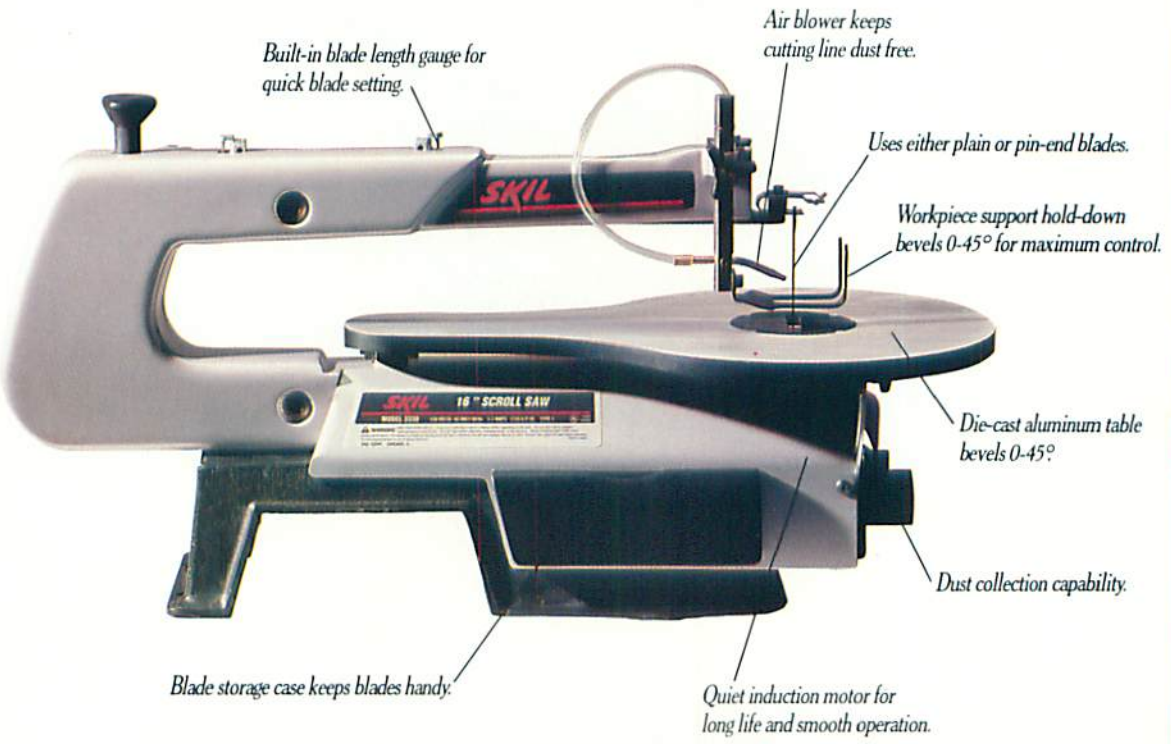
Its Distinguishing Features Are Only Surpassed By Its Distinguished Name.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Uses either plain or pin-end blades.
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The Woodworker's Journal
SEPTEMBER/OCTOBER 1992 VOLUME 16, NUMBER 5

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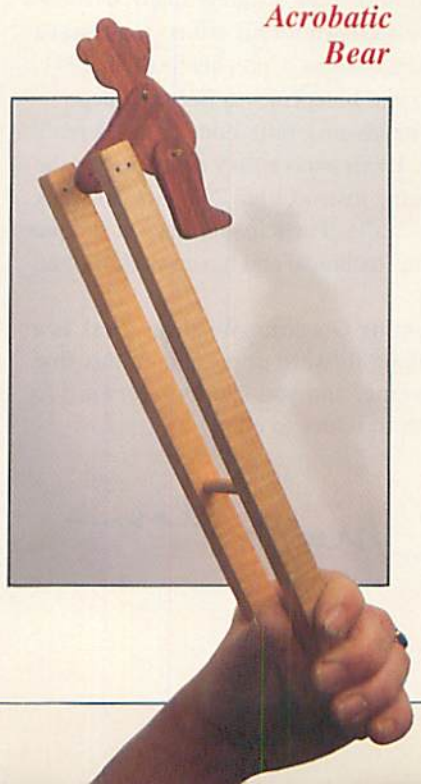


48 Step Stool/Chair

Shoptalk

Where Do All Those Great Projects Come From?

Have you ever wondered where all the projects featured in *The Woodworker's Journal* come from? Each project has a different tale to tell, and this big issue is typical. Three projects, the convertible Step-Stool, the Finger-Saving Plastic Bag Handle, and the Universal Table Saw Jig arrived unsolicited, over-the-transom, so to speak.

The designer-builder of the Step-Stool, subscriber A.B. Beavers, actually drove all the way from his home in Texas to deliver the prototype to our Connecticut offices, using the occasion to enjoy a New England vacation with his wife Darline.

We aren't usually fortunate enough to have great projects hand-delivered halfway across the country to our door. More commonly, we're hunched over our drawing boards working out our own designs or out on the road traveling to craft shows, always on the lookout for that project with a little something special . . . a piece that combines function with good design and sound construction. And, if you're thinking that any piece good enough to share all those qualities belongs in a museum . . . well, you're right . . . we also look to museums for project ideas.

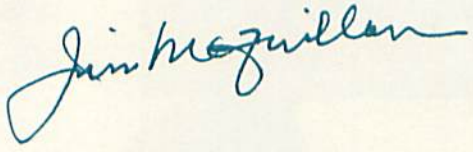
A New Friend

Over the years we've featured projects from a number of museums and collections, including the Metropolitan Museum of Art and Hancock Shaker Village. Most recently we've concluded an agreement with Berea College in Kentucky to bring you the first of what we hope will be a long list of projects from that college's world renowned Wallace Nutting Collection. We're starting off with the classic Governor Winthrop Desk (see the back cover of this issue for photo), and it will be featured in the upcoming November/December issue.

Nutting, an eccentric character whose career spanned many decades and even more vocations, is perhaps best known for his efforts to preserve Colonial American culture and furniture designs. Upon his death in 1941, he bequeathed his furniture collection and blueprints to Berea College.

Long recognized as a center for hands-on crafts education, Berea's Crafts Program will be celebrating its 100th anniversary next year. In the program, students pay no tuition, working instead 10 to 20 hours per week at woodworking, weaving and other crafts. Participants have a unique opportunity to gain practical experience, technical and business skills, and income while they earn their degree.

We think you'll agree that the upcoming Governor Winthrop Desk is a very special project. We're really looking forward to presenting this fine example of Colonial period woodworking, and you can look forward to more of the Wallace Nutting collection in issues to come.



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Letters

We welcome opinions and comments (both pro and con) from our readers. Address correspondence to: Letters Department, ***The Woodworker's Journal,*** *P.O. Box 1629, New Milford, CT 06776.*

Owners of Sears Craftsmen table saws and other Sears power machines should be aware of a potentially dangerous ON/OFF switch. The problem could also apply to any other manufacturers that use 110 volt switches with similar internal mechanisms.

I have a 10 in. Craftsman table saw, the kind that has the switch with a removable yellow plastic "key." A couple of months ago, the saw didn't shut off when I flipped the switch to the OFF position. Upon moving the toggle ON/OFF again, the power was cut, and the saw stopped. I could only imagine that a bit of sawdust must have held the internal parts of the switch in the ON setting.

It worked okay after that, or so I thought, until the day my wife came into the house and asked me why the table saw had suddenly started up as she walked through the shop. This time I had to pull the plug in order to shut it off.

The switch has been repaired, but in the future, I'm going to be sure to unplug the power cord anytime I need to change the blade. I'd also suggest that if your switch should stick ON, even momentarily, have it repaired or replaced immediately.

Marvin Collins, Eureka, Calif.

Editor's Note: At the request of Sears, we passed Mr. Collins letter along to Emerson Electric, the company that manufactures many of the Sears Craftsman table saws. Here is their reply:

We appreciate and share Mr. Collins' interest in safety. In this instance, we are unable to offer any explanation for this phenomenon. This switch design has been used for decades on millions of power tools and has demonstrated exceptional reliability. Still, it is always good practice to unplug a power tool before attempting to change the blade. In addition, if the power switch, or any other safety device, does not operate normally, you should have it repaired before continuing. Finally, power components, such as switches and motors, should only be serviced by persons specifically trained to do so.

Emerson Electric
Special Products Division
Hazelwood, Mo.

I enjoyed making the Shoot-the-Moon Roller Ball Game from the May/June 1992 issue. After some practice, I was even able to get the ball into the hole that scored 500 points.

I made a few minor changes that I thought your readers might find of interest. Instead of using the four round felt feet, I covered the entire underside of the base with a sheet of pressure sensitive green felt. And, for the numbers on

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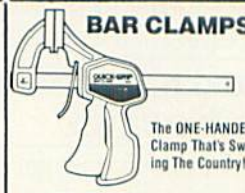

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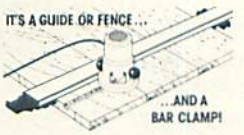

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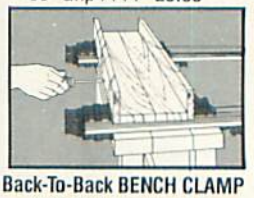

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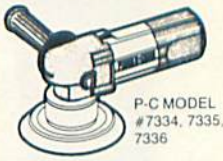

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the hole pockets, I used the sticker numbers found on the instructional folder that comes in each video tape cassette. Those numbers gave the game a real professional look. Keep up the good work.

Samuel Harelick, Bayonne, N.J.

I had just bought a new drill press when your May/June issue arrived with plans for a Swing-Away Drill Press Organizer.

Using pieces from my scrap pile, I made all the parts in a couple of hours. However, I had to include a couple of changes to accommodate my drill press design. The brackets (part A) on the column were offset to provide clearance for the feed handle, and I lengthened the arm (part D) from 8 in. to 10 in.

Bert Skruibis, Bath, Ont.

I found great interest in the article "Collet Chuck Turning," by Nick Cook, in your May/June 1992 issue. Even though my lathe can't handle collets, I was able to make 25 Wine Bottle Stoppers out of white oak, cherry, and mahogany. Your publication is terrific.

Gil Mathews, Guilford, Conn.

Odds and Ends

In our July/August 1992 issue, there is an incorrect dimension in the Bill of Materials for the Side-By-Side Chest Cupboard. As shown, the side (part A) is $53\frac{1}{2}$ in. long. The correct length for the side is $52\frac{3}{8}$ in.

The Northeastern Woodworker's Association meets the second Thursday of January, March, May, and September, at 7 PM, in the Price Chopper's community room, 1639 Eastern Parkway, Schenectady, New York. Guests are welcome. Contact Herman Finkbeiner, 492 Riverview Rd., Rexford, NY 12148.

The KYANA Woodcrafters meet the first Thursday of each month at 7:30 p.m. in the Bethel United Church of Christ, 4004 Shelbyville Rd., Louisville, KY 40207. Visitors are cordially invited.

Your safety is important to us . . . We strive to present our plans and techniques as accurately and safely as possible, and we try to point out specific areas and procedures where extra caution is required. But because of the variability of local conditions, construction materials and personal skills, we can't warn you against all potential hazards. Remember to exercise common sense and use safety measures when operating woodworking power equipment. Don't attempt any procedures you're not comfortable with or properly equipped for. Sometimes, for the sake of clarity, it's necessary for a photo or illustration to show power tools without the blade guard in place. In actual operation, though, you should always use blade guards and other safety devices on power tools that are equipped with them. Remember . . . an ounce of prevention really is worth a pound of cure.

—The Editors

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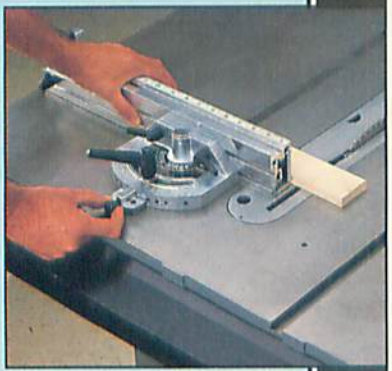

We do not recommend operating without the saw blade guard, as is shown here.
US Patent Pending

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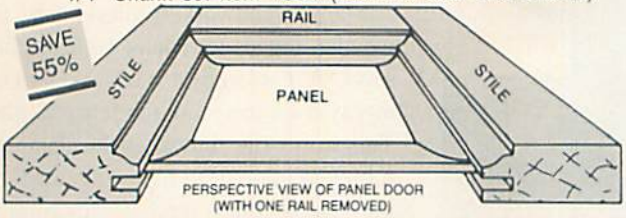

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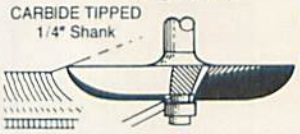

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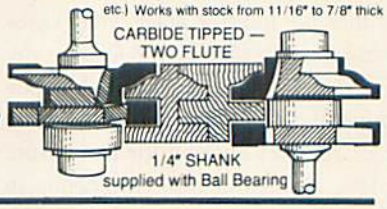

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#531		5/16" Edge Beading	5/16" Dia. of Circle		1/2"	1/4"	$15.50
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#351		3/16" Round Over	3/16" R	7/8"	1/2"	1/4"	$11.00
#230		1/4" Round Over	1/4" R	1"	1/2"	1/4"	$12.00
#353		5/16" Round Over	5/16" R	1 1/8"	1/2"	1/4"	$14.00
#209		3/8" Round Over	3/8" R	1 1/4"	5/8"	1/4"	$15.00
#355		1/2" Round Over	1/2" R	1 1/2"	3/4"	1/4"	$17.00
#655		1/2" Round Over	1/2" R	1 1/2"	3/4"	1/2"	$17.00
#656		3/4" Round Over	3/4" R	2"	7/8"	1/2"	$21.00
#199		Multiform Moulding	Unlimited Patterns	2 1/4"	2"	1/2"	$40.00
#205		1/4" Cove	1/4" R	1"	1/2"	1/4"	$12.00
#206		3/8" Cove	3/8" R	1 1/4"	9/16"	1/4"	$13.00
#207		1/2" Cove	1/2" R	1 1/2"	5/8"	1/4"	$14.00
#643		1/2" Cove	1/2" R	1 1/2"	5/8"	1/2"	$15.00
#208		3/4" Cove	3/4" R	1 7/8"	3/4"	1/2"	$26.00
#231		5/32" Roman Ogee	5/32" R	1 1/4"	15/32"	1/4"	$16.00
#232		1/4" Roman Ogee	1/4" R	1 1/2"	3/4"	1/4"	$17.00
#506		1/2" Pattern	Flush Trim	1/2"	1"	1/4"	$15.00
#508		3/4" Pattern	Flush Trim	3/4"	1"	1/4"	$17.00
#366		1/8" Slot Cutter	3/8" Deep	1 1/4"	1/8"	1/4"	$14.00
#368		1/4" Slot Cutter	3/8" Deep	1 1/4"	1/4"	1/4"	$14.00
#204		3/8" Rabbeting	3/8" Deep	1 1/4"	1/2"	1/4"	$13.00
#670		3/8" Rabbeting	3/8" Deep	1 1/4"	1/2"	1/2"	$14.00

ITEM NO.	BEST CUT BEST PRICE	DESCRIPTION	ANGLE/DEPTH/RADIUS CIRCLE DIAMETER	LARGE DIA.	CUTTING LENGTH	SHANK SIZE	PRICE
#211		3/8" Core Box	round nose	3/8"	3/8"	1/4"	$10.00
#212		1/2" Core Box	round nose	1/2"	11/32"	1/4"	$13.00
#418		3/4" Core Box	round nose	3/4"	5/8"	1/4"	$15.00
#213		1" Core Box	round nose	1"	3/4"	1/2"	$17.00
#548		Lockmitre		2"	7/8"	1/4"	$32.00
#214		1/4" Straight	plunge cutting	1/4"	3/4"	1/4"	$ 6.50
#216		3/8" Straight	plunge cutting	3/8"	1"	1/4"	$ 6.50
#474		1/2" Straight	plunge cutting	1/2"	1"	1/4"	$ 7.00
#219		3/4" Straight	plunge cutting	3/4"	1"	1/4"	$ 9.50
#779		3/4" Straight	plunge cutting	3/4"	1 1/2"	1/2"	$10.00
#462		1/2" Bull Nose	1/2" Dia. of Circle		3/4"	1/4"	$16.00
#464		3/4" Bull Nose	3/4" Dia. of Circle		1"	1/4"	$21.00
#764		3/4" Bull Nose	3/4" Dia. of Circle		1"	1/2"	$21.00
#545		Tongue & Groove	Straight	1 5/8"	1"	1/4"	$29.00
#345		Tongue & Groove	Straight	1 5/8"	1"	1/2"	$29.00
#546		Tongue & Groove	Wedge	1 3/16"	1"	1/4"	$29.00
#846		Tongue & Groove	Wedge	1 5/8"	1"	1/2"	$29.00
#450		1/8" Beading	1/8" R	3/4"	3/8"	1/4"	$11.00
#233		1/4" Beading	1/4" R	1"	1/2"	1/4"	$13.00
#454		3/8" Beading	3/8" R	1 1/4"	5/8"	1/4"	$15.50
#455		1/2" Beading	1/2" R	1 1/2"	3/4"	1/4"	$17.00
#500		3/8" Flush	Trimming	3/8"	1/2"	1/4"	$ 7.00
#501		3/8" Flush	Trimming	3/8"	1"	1/4"	$ 7.50
#503		1/2" Flush	Trimming	1/2"	1"	1/4"	$ 8.50
#221		1/2" Flush	Trimming	1/2"	1 3/16"	1/2"	$ 8.00
#558		Thumbnail		1 3/16"	3/8"	1/4"	$18.50
#858		Thumbnail		2 1/2"	3/4"	1/2"	$35.00
#579		Molding Plane		1 1/8"	1 3/4"	1/4"	$31.95
#879		Molding Plane		1 1/8"	1 3/4"	1/2"	$31.95

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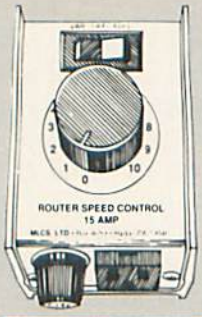

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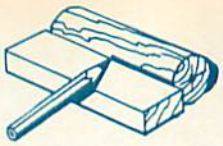
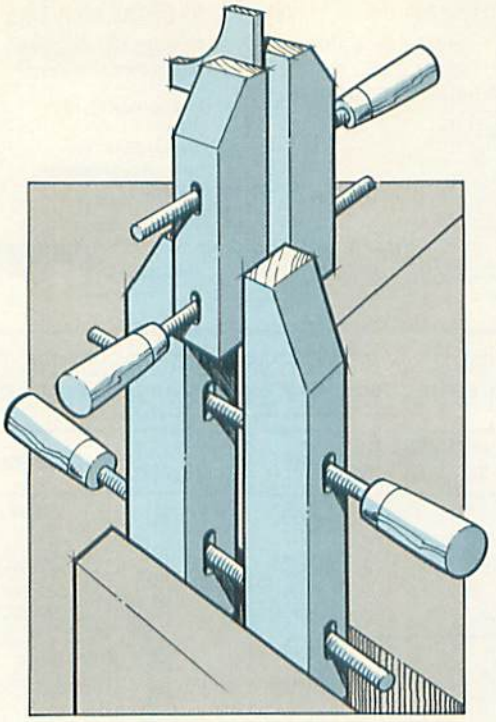


Shop Tips

Kids have a natural curiosity that can sometimes put them in places they know they shouldn't be. So, before leaving my shop, I always make sure my table saw blade has been lowered below the table surface. And, as an additional measure of safety, I take a few moments to position the rip fence over the blade, then I lock the fence in place.

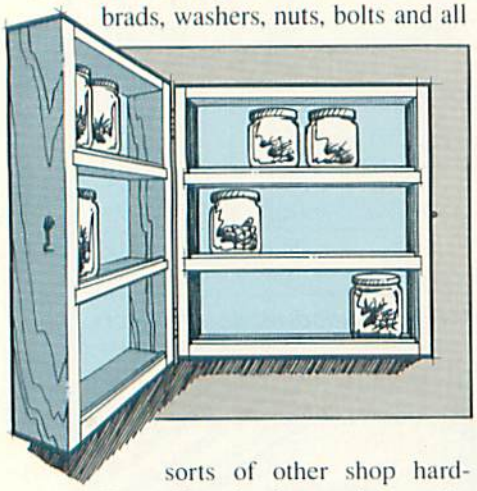
Kris A. Kalanges, Gresham, Ore.

Oftentimes, a flat surface is best clamped simply by adding weight to the parts. This technique works particularly well when veneering or face gluing stock. A stack of books, or even a few bricks, will usually do the job, but if you need a lot of clamping force, try using a few barbell weights. They are easily stacked and will likely provide all the weight you'll need.



A handscrew can double as a vise that's perfect for holding small parts. We sometimes use two, as shown, to raise the part to a comfortable working height.

A small wall cabinet, especially designed for baby food jars, will provide convenient storage for screws, nails, brads, washers, nuts, bolts and all sorts of other shop hardware. By making the door as deep as the cabinet side, the storage area is doubled. A 1/4 in. by 1/4 in. strip is nailed to the front of each shelf to keep the jars from slipping off. The case parts can be made from 1/2 in. or 3/4 in. thick stock, while 1/4 in. thick plywood is a good choice for the front and back.



C. Wayne Close, Grants Pass, Ore.

Fine or extra-fine grit "valve grinding compound," sold at auto supply stores, makes an excellent honing paste for a leather strop.

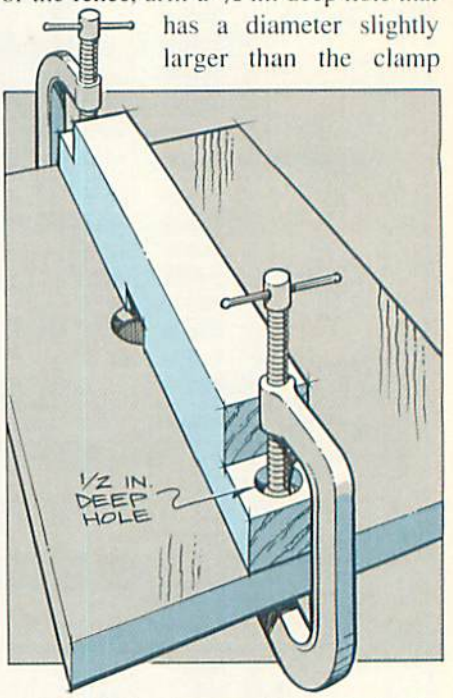
When clamps are tightened, the pressure that's concentrated at the jaws will often mar the surface of the workpiece. Distributing this pressure will greatly reduce the damage, so woodworkers often insert a block of scrap wood, called a clamp pad, between the clamp jaws and the workpiece. These wooden clamp pads work pretty well, but it usually takes three hands to hold the two pads in place while tightening the clamps. More often than not, the pads end up on the shop floor before you secure the clamp.

There is an easier way. Use a hot-glue gun to "cement" the clamp pad to your jaws. The pads stay firmly in place for your clamping jobs, but can be removed (and the glue peeled off) with a minimum of effort.

Jay Ogle, Chalfont, Penn.

Many woodworkers make their own wooden fences for router tables or band saws. A C-clamp at each end is commonly used to secure the fence in place. This works fine, but when the clamps are loosened in order to reposition the fence, the clamps often tend to slip from the fence. Prudent woodworkers quickly learn to avoid putting toes under the C-clamps.

Here's an easy way to keep the loosened clamps at home. On each end of the fence, drill a 1/2 in. deep hole that has a diameter slightly larger than the clamp pad. With the clamp pad in the hole, the loosened clamp won't slip because it wedges against the wall of the hole.



Fred Coburn, Dolores, Colo.

The Woodworker's Journal *pays $25-$100 for reader-submitted shop tips that are published. Send your ideas (including sketch if necessary) to:* ***The Woodworker's Journal,*** *P.O. Box 1629, New Milford, CT 06776, Attn: Shop Tip Editor. We redraw all sketches, so they need only be clear and complete. If you would like the material returned, please include a self-addressed stamped envelope.*

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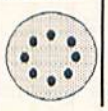

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#DC1 ..... **$199.95** (UPS $20)

Events

We will gladly list as many events of interest to woodworkers as space permits. Listings are free and may include shows, fairs, competitions, workshops and demonstrations. The deadline is eight weeks before publication—November 1 for the January/February 1992 issue. Please address announcements to the Events Department. Readers planning on attending events should call ahead if possible. Scheduled dates and locations sometimes change between publication and the date of the event.

Connecticut: Application deadline for a juried exhibition of crafts in all media is Sept. 18, 1992. Festival dates are Nov. 7–Dec. 24. For information, contact the Guilford Handcrafts Center, P.O. Box 589, Guilford, CT 06437; tel. (203) 453-5947.

Application deadline for the Brookfield Craft Center's 1992 Holiday Sale & Exhibition (to be held Nov. 20–Dec. 24) is Oct. 1, 1992. For information contact the Center at P.O. Box 122, Brookfield, CT 06804; tel. (203) 775-4526.

The Connecticut Woodworking Show, Oct. 9–11, Veterans Memorial Coliseum, New Haven. For more information call 1-800-826-8257.

California: The 1992 Palm Springs Wildlife Art Show and Wildfowl Carving Competition, Oct. 10–11, Riviera Resort and Racquet Club. For information contact Lloyd MacBride at (714) 845-2237.

Canada: (Ontario) The Pickering Wood Show, Oct. 16–18, Metro Trade East Centre, Pickering (near Toronto). For information call (519) 351-8344.

District of Columbia: The Washington DC Woodworking Show, Sept. 25–27, DC Armory, Washington, DC. For information call 1-800-826-8257.

Georgia: Woodworking World—The Atlanta Show, Oct. 9–11, Radisson Hotel, Atlanta. For information call 1-800-521-7623.

Illinois: The Chicagoland Woodworking Show, Sept. 18–20, Odeum, North Hall, Villa Park. For more information call 1-800-826-8257.

Massachusetts: Woodworking World—The New England Show, Oct. 16–18, Eastern States Exposition Center, West Springfield. For information call 1-800-521-7623.

Michigan: The Metro-Detroit Woodworking Show, Oct. 16–18, Michigan Fairgrounds, Community Arts Building, Detroit. For more information call 1-800-826-8257.

Minnesota: The Twin Cities Woodworking Show, Oct. 2–4, Minnesota State Fairgrounds, Empire Commons Building, St. Paul. For more information call 1-800-826-8257.

Missouri: The St. Peters Woodworkers Guild and the St. Charles Area Woodcarvers Club's 3rd Annual Wonders of Wood Show, Sept. 12–13, St. Peters Cultural Arts Center, St. Peters. For information call (314) 928-8571.

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New York: Woodworking World—The Suffern Show, Oct. 2–4, Rockland Community College, Suffern. For information call 1-800-521-7623.

Woodworking World—The Central New York State Show, Oct. 30–Nov. 1, New York State Fairgrounds, Syracuse. For information call 1-800-521-7623.

North Carolina: Woodworking World—The Carolina Show, Sept. 25–27, Omni Durham Hotel, Durham. For information call 1-800-521-7623.

Ohio: Woodworking World—The Berea Show, Oct. 23–25, Cuyahoga County Fairgrounds, Berea. For information call 1-800-521-7623.

The Greater Columbus Woodworking Show, Sept. 11–13, Ohio Expo Fairgrounds, Columbus. For information call 1-800-826-8257.

Oregon: The Oregon Woodworking Show, Oct. 30–Nov. 1, Portland Expo Center, Portland. For information call 1-800-826-8257.

Pennsylvania: Yorkcarvers' 18th Annual Woodcarving & Decoy Show, Sept. 27–27, York College, York. For information, call (717) 566-0239.

9th Annual Penn's Colony Festival, Sept. 19–20, 26–27, North Park, Pittsburgh. For information call (412) 241-8006.

Tennessee: 10th Annual Smokey Mountain Woodcarvers Show, Sept. 25–27, Dollywood's Valley Exhibition Hall, Pigeon Forge. For information call Jack Williams at (615) 691-1855.

4th annual wood products seminar "Quality Lumber: Sawing, Grading, and Drying," Sept. 25–26, TVA Forestry Building, Norris. For information, call Bill Parrish at (615) 632-1656.

Texas: Los Amigos del Mesquite Annual Convention, Competition and Trade Show, Sept. 24–27, Wyndham Hotel, Austin. For information, contact Herb Nordmeyer, P.O. Box 68, Knippa, TX 78870; tel. (512) 934-2616.

Washington: The Western Washington Woodworking Show, Oct. 23–25, Seattle Center, Exhibition Hall, Seattle. For information call 1-800-826-8257.

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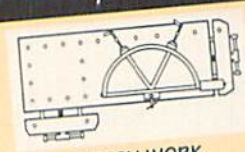

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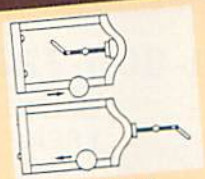

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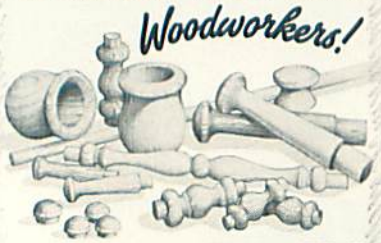

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Readers' Information Exchange

Looking for an owner's manual for an old band saw? Need a bearing for a hand-me-down table saw? Can't find a source of supply for an odd piece of hardware? Maybe our readers can help. Send along your request and we'll try to list it here—and perhaps one of our readers will have an answer for you. We'll include as many requests as space permits.

I want to buy an adz known as a shipfitter's "lipped" adz. The cutting edge is straight, about 4 1/2 in. wide with the ends curved in a sort of lip.

Wallace Froiseth
791 Sunset Ave., Honolulu, HI 96816

I need parts for a Shopcraft 10 in. band saw, model no. T6760 20P, manufactured by BenchMark Tool Co.

Louis L. Johnson
217 E. 8th Ave., Milbank, SD 57252

I have a Craftsman 24 in. scroll saw, model no. 103.0403 and I need an owner's manual, table insert and boot that goes over the lower shaft and crankcase.

R.L. Summers
890 Arcadia Dr., Eugene, OR 97401

I have an 8 in. table saw made by King Machinery, Inc. (King brand tools) and a professional quality airless electric paint spray gun, model no. KC-839, made by Precise Tools. I'm looking for current addresses or information on both of these companies.

Victor Sumner
P.O. Box 711, 263 S. Park Rd.
Herscher, IL 60941-0711

I have an older model Sears 4 1/2 in. jointer which is missing the blade guard and fence. The serial tag is missing, but there's a tag saying it was made by King Seeley Corp. Does anyone know where I might find these two parts?

Brian Lewia, Industrial Arts Dept.
Skowhegan Area High School
Skowhegan, ME 04976

I need an owner's manual and parts list for a Wizard 1/2 in. drill and for the following 30+ year old Craftsman tools: wood lathe, model no. 103.23180; 1/2 in. drill press, model no. 103.23140; metal lathe, model no. 109.0703; table saw, model no. 113.27700. Does anyone make a mortising bit holder for the old Sears drill press with the vertical depth gauge mounted on the spindle like mine? I also need a blade guard for the table saw mentioned above.

John Maxwell
442 Robertsville Rd.
Oak Ridge, TN 37830

I need an owner's manual and any information regarding the U.S. manufacturer's representative for a Rexon 15 in. thickness planer, model no. RDW-168, serial no. 543, dated 1984. Since the machine isn't working, any comments about the performance of Rexon thickness planers would also be welcome.

C. Clyde Crittenden, Wood Shop Dir.
Happy Hill Farm Academy/Home
Star Route Box 56, Granbury, TX 76048

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Toolkraft band saw, model no. 385 C Rev. II, Springfield, Mass. . . . . *Philip C. Hessburg, MD, 15401 E. Jefferson, Grosse Pointe, MI 48230*

Walker Turner 10 in. band saw; Craftsman 8 in. table saw, pat. no. 2121069, 21 June 1938 . . . . . *James Rye*
Rt. 12 Box 56, Dothan, AL 36303

Skil circular saw, model 77, July 1949; Super Shop (multi-tool), manufactured by Power Tools, Inc., Beloit, Wisc. . . . . *Fred C. Moore*
P.O. Box 13165, Knoxville, TN 37920-0165

Sears Craftsman scroll saw, model no. 103.2179 . . . . . *Mel Bryan*
204 Redwing, Lees Summit, MO 64063

Sears 8 in. table saw, model no. 103.22161 . . . . . *John Skyt*
143 Old Hartford Rd., Colchester, CT 06415

Sears scroll saw, model no. 103.23150 . . . . . *Ron Shelton*
15869 Calandria Way, Victorville, CA 92392

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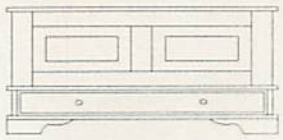

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An Introduction to Chairbuilding

Fundamental techniques not hard to master

For many years, I avoided making chairs and turning wood whenever I could. I'm a cabinetmaker at heart, happiest when wielding saws, planes and chisels on nice rectilinear chests and tables. Chairs were full of all sorts of weird angles and places where too many joints met in too little wood. And turning, with its own special tools and techniques, seemed too demanding for someone still trying to marshal a modest repertoire of cabinetmaking skills.

Then, a few years ago I took a fancy to Windsor chairs. Unfortunately, Windsors, which consist largely of turned parts joined at all sorts of weird angles, neatly combined my two woodworking phobias. I felt like a child confronting a monster beneath my bed.

I'm happy to say that I conquered my monster, and if you're similarly afflicted, you can too. Windsors turned out to be an ideal project for a reluctant chairmaker and turner; once I got started, I had a lot of fun. If you need a ready-made project, the child's Windsor shown here is excellent for a beginner—the turnings are simple and the construction is forgiving. (See Child's Windsor, page 40, for plans.)

Simple and accessible as this project is, it is impossible to teach a beginner how to turn or to make a chair in a magazine article. I'll map out the process and provide some guidance and suggestions, but for the full treatment, I strongly suggest you consult the same experts that I did when I started out. Michael Dunbar, who has done much to revive the art of Windsor chairmaking, covers the subject thoroughly in his book, *Make a Windsor Chair with Michael Dunbar* (Taunton Press, $13.95). I had tried and failed to learn woodturning from a number of books before I watched Richard Raffan's video-tape, *Turning Wood* (Taunton Press, $39.95). Turning skills are fluid, and video is the perfect medium to convey them. Watching the tape cleared up a great deal of confusion for me.

The Project

Although at first glance Windsors appear to be a daunting collection of complicated angles, they are actually much easier to make than what I call cabinetmaker's chairs. Made of more-or-less rectilinear parts, a cabinetmaker's chair might be said to grow from a piece of paper—its dimensions and angles must conform exactly to those laid out in drawings or the chair doesn't work. A Windsor, on the other hand, grows from its wooden seat, the final dimensions and angles being determined as you make and assemble the chair. Of course, there is a plan, but think of it as a sketch, rather than a rigid template. The actual length of the stretchers, for example, and the angles at which they join the legs are determined not from the plan, but directly from the legs after they've been socketed into the seat. None of the turnings on my first Windsor, or the angles at which they joined together, matched those on the plan, but I'm still sitting on the chair almost 10 years later.

The little Windsor shown here, which was discovered in a friend's antique collection by one of the folks at *The Woodworker's Journal*, is also a good project for the novice woodturner. Consisting of cylinders and a few gentle curves, its turnings are ideal for practicing basic gouge and skew-chisel cuts. (I'll discuss cutting techniques later.) It is oddly proportioned—its legs appear to be the top third of a full-size "bamboo" pattern leg—but it has an ungainly sort of charm.

Tools

You don't need a lot of tools to make this chair. I used the two gouges and two skew chisels shown in Photo A, and several outside calipers to check diame-

Photo A: The author turned all the parts for the child's chair with only these four tools (from left to right): A deep-fluted, 1 in. square-nose gouge for roughing out; a shallow 1 in. thumbnail-ground gouge for shaping; a large skew, 1 in. wide, for shaping and finishing; and a small, 1/2 in. skew for trimming tenons. (The exact sizes are not critical.)

ters. Following Richard Raffan's advice, I grind a curved edge on my skew chisels, which allows a little more finesse in their use than does a straight, angled edge. And I use the tools straight from my bench grinder's 100-grit wheel, saving much time and effort honing with slipstones. Ground carefully, with a light touch, the edges cut cleanly.

You won't need many tools at the workbench, either. Lacking a band saw, I shaped the seat and back rail with a handsaw, drawknife and spokeshave. A brace and a few auger bits and a sliding bevel or two takes care of the sockets, and a couple of chisels cut the mortises in the seat posts for the back rail.

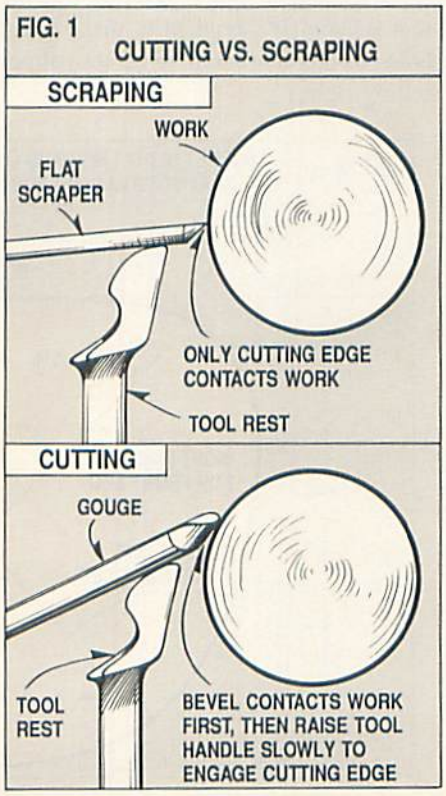
Materials

Traditionally, Windsors were made of several different woods, each with properties suited to its use. Seats were frequently pine, easily worked for dished and shaped seats. Harder woods work, too—the simple flat seat on the child's Windsor appears to be oak or ash. Fine-grained, sturdy and easy-to-turn woods such as maple and birch were commonly used for the legs and stretchers, and for many turned parts above the seat. The legs, stretchers, arms, arm posts and back posts on this chair seem to be made of one or more of those woods. For any part that required bending to shape (bow backs, for example) and for the thin back spindles, which had to be resilient, ash, oak or hickory were used. This chair's spindles are turned (many were fashioned with drawknife and spokeshave) and, interestingly, two are maple or birch, one is ash or oak. The back rail is chestnut.

With the exception of the seat, traditional Windsors were frequently made of "green" wood. Split from the log and worked while still wet, green wood is both cheaper and easier to turn, bend or shave than sawn and dried wood. And splitting produces straight-grained stock essential for maximum strength in small-diameter parts. I encourage you to try green wood, particularly if you are a novice at the lathe—turning green wood is like slicing butter with a hot knife. I get mine from local firewood suppliers; I've pulled the materials for small projects like this right out of a pile of newly split firewood. I split the pieces into turning blanks using a froe and maul or a hatchet. You can also rip them on a band saw. Lacking green wood, cut your turning blanks from straight-grained planks.

Lathe Technique

There are basically two methods of removing wood on a lathe. You can scrape it off, using flat tools whose cutting edges are ground to various curves. Or you can cut it off, shearing the fibers just as you do with a sharp pocket knife or handplane (Fig. 1). Scraping has its uses in bowl turning, but for between centers work like this, it often produces rough surfaces, a lot of dust and little satisfaction. Once you get the hang of it, cutting is a superior technique for almost all turning between centers, providing much greater control for producing flowing curves and sharp, crisp details. Long clean shavings spool off the cutting edge (particularly when working green wood), leaving surfaces in need of little or no sanding.



Like any skill, cutting takes practice—and plenty of mistakes—to master. Study the Raffan tape (or another source), then chuck up a turning blank and give it a try. Here are a few things to keep in mind as you work. Make sure the tool is in solid contact with the tool rest before it touches the wood. After you've roughed the blank to a cylinder, remember that the bevel, not the cutting edge, should contact the wood first, then raise the tool handle slowly to engage the edge and begin cutting.

Seat, Legs and Stretchers

I make the base of the chair—its seat, legs and stretchers—first, then build the back and arms. The seat is simple. With its flat surfaces top and bottom, all that's needed is to cut it out of a thick plank and clean up the edges. I beveled the edges with a spokeshave; you could use a disk sander with an adjustable table, too. (I bore the sockets for the legs after turning the legs.)

Turning the Legs: Setting the seat aside, turn the legs. First, some preparation. I set calipers to measure important diameters: one to the leg's largest dimension, one to the diameter at its bottom, and one to the diameter of the tenon shoulder (which is about 1/8 in. greater than the finished tenon). I also make a crude template, marking critical features—the tenon shoulder, the widest point on the leg and the three rings—on a flat stick, from which I can easily transfer them to the spinning blank.

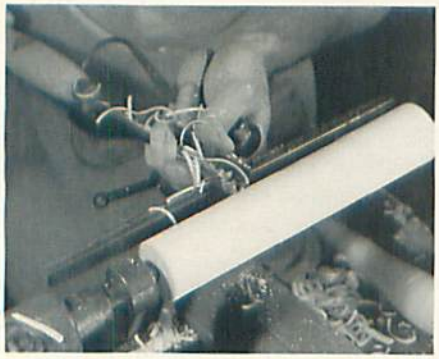


Photo B: The first step in turning between centers is to rough-cut the blank to a cylinder. Here, the author uses a heavy, square-nose gouge to rough out a leg blank.

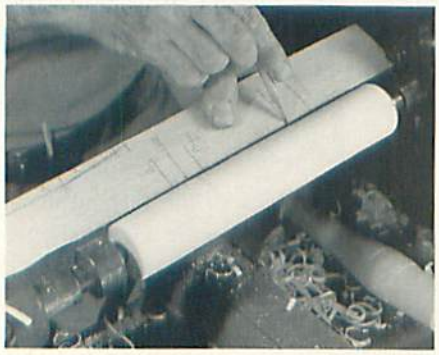


Photo C: Transfer critical measurements from a simple template to the spinning blank with a soft pencil. Positioning the template against a fixed object, like the headstock, makes it even easier to use.

Cut the blanks an inch or so longer than the leg's anticipated length (including the tenon). Rough turn the blank to a cylinder slightly larger than the leg's largest diameter (Photo B). Use the template to mark the position of the widest diameter (Photo C), then rough out the curves with the thumbnail-ground gouge, working "downhill," from the larger to the smaller diameters (Photo D). A skew chisel finishes the curves and the surfaces (Photo E). I've practiced using the skew both right and left handed, which makes downhill work with the skew much quicker and easier.

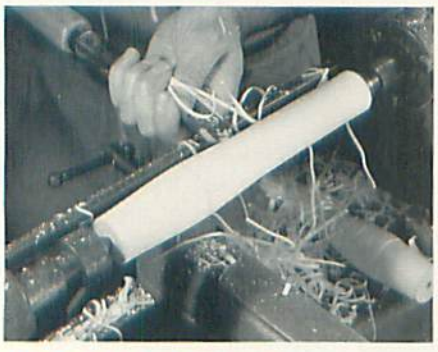


Photo D: The thumbnail-ground gouge roughs out sweeping curves. Used skillfully, you can make fine finishing cuts with one, too.

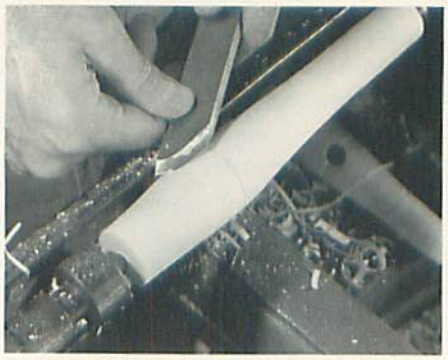


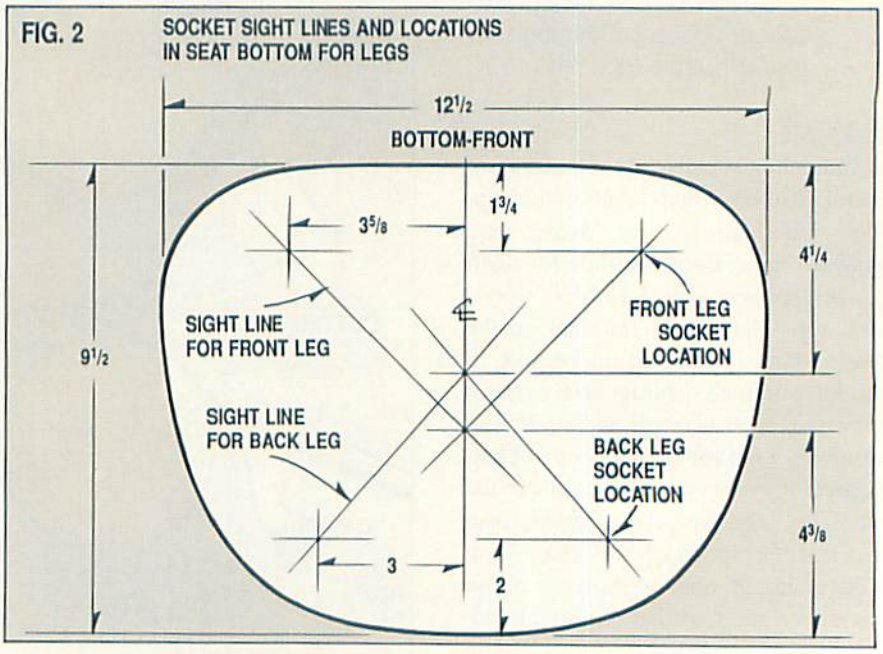
Photo E: Here, a large skew chisel finishes the curve, leaving a smooth surface. Always work "downhill," from larger to smaller diameters.

If you're working with green wood, leave the tenon slightly oversized for now. The leg will dry fairly quickly, and its shrinkage will throw the tenon out of round. (When I want to speed the drying process, I stick the tenons into a bucket of sand heated on a camp stove.) When the tenon is dry, remount the leg and turn it down to size (Photo F). Make the tenon a snug, but not a drive-in fit, to the seat socket. (It's prudent to make a test hole and tenon in scrap, to get the caliper setting right.)

Photo F: Size the tenon with a small skew. (If you are working with green wood, do this after the tenon has dried.)

Socketing the Seat: Some experienced Windsor chairmakers bore the leg sockets in the seat by eye—they have a feel for the right angles. The rest of us need a little help. After a lot of fiddling around, I came up with a fairly simple way of setting up these angles, which is shown in the drawings (Figs. 2 and 3). On the seat bottom, draw a center line and lay out positions of the sockets. Then draw the sight lines as also indicated in Fig. 2 by connecting the appropriate points along the seat's center line with the positions of the sockets. Set a sliding bevel to the correct angle and place it along the proper sight line (Fig. 3). Then bore the hole, as shown in Photo G. (Don't worry if your angles end up a bit off—the chair will still work fine.) This chair has blind seat sockets, but I prefer extending the sockets

FIG. 2 SOCKET SIGHT LINES AND LOCATIONS IN SEAT BOTTOM FOR LEGS



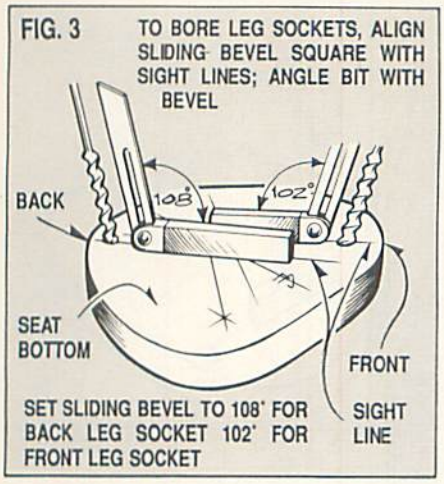


FIG. 3
TO BORE LEG SOCKETS, ALIGN SLIDING BEVEL SQUARE WITH SIGHT LINES; ANGLE BIT WITH BEVEL
BACK
108°
102°
SEAT BOTTOM
FRONT
SET SLIDING BEVEL TO 108° FOR BACK LEG SOCKET 102° FOR FRONT LEG SOCKET
SIGHT LINE

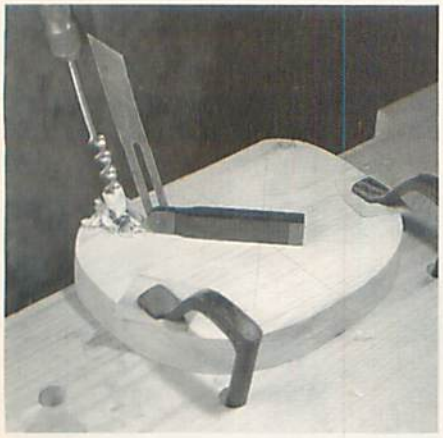


Photo G: To bore holes for the leg tenons, align the brace and bit with the sliding bevel placed on the appropriate 'sight line.' A piece of tape on the bit serves as a depth stop.

through the seat and wedging the tenons in place for a stronger construction.

The Stretchers: After boring all four leg sockets, insert the legs and measure to find the distance between the shoulders of each stretcher (Photo H). Because the depth stop on my brace and bit is so crude, I prefer to turn shoulders on the stretchers rather than let them bottom out in the holes. Add about 1/8 in. to the shoulder-to-shoulder measurement, which pushes the legs slightly apart and strengthens the base. Remember to add the tenons on each end, plus an allowance for waste when cutting the turning blanks to length.

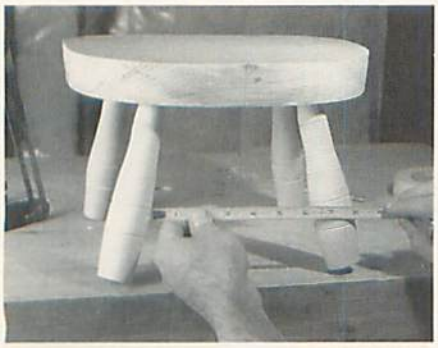


Photo H: Insert the chair legs and measure to find the length of the stretchers.

The cigar-shaped stretchers aren't too tough to turn, though it can be frustrating to get the gentle curves to match on both sides of the widest diameter. Small-diameter parts, such as the stretchers, sometimes vibrate against the tool. You can use a hand as a steady rest to control this "chattering," as shown in Photo I. Again, in green wood, turn the tenons oversize, and let them dry before turning them to final diameter.

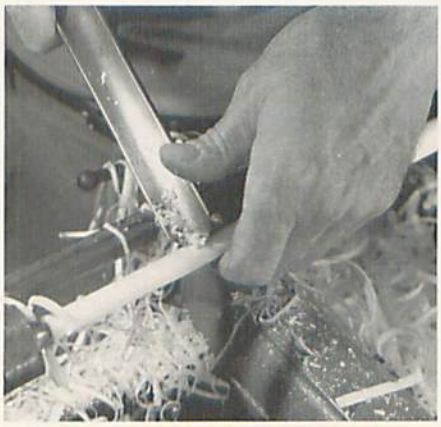


Photo I: When turning small-diameter parts like stretchers and spindles, steady the work with your hand to prevent the part from vibrating.

Socketing for the Stretchers: Boring the first socket in each leg is a relatively simple task. I pair the legs, boring sockets for the front and back stretchers first, then the side stretchers. Assemble the legs and seat (dry—without glue) and set a sliding bevel to the correct angle, as shown in Photo J. Grip the leg in a vise and bore the socket, checking the bit angle against the bevel (Photo K). Do the same for the other front (or back) leg, then dry-assemble the base again.

The second socket presents a complication—two angles to deal with. Set two bevels, then use them together to guide you while boring the socket (Photo L). Dry assemble the base, checking to see that the stretcher's tapered shoulders are all firmly seated in the leg sockets. If not, the tenons are bottoming in the sockets and should be trimmed. Set the legs and stretchers aside while you work

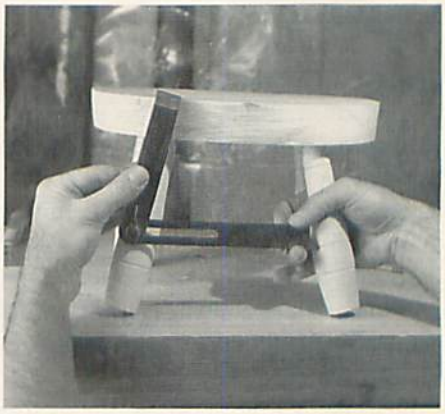


Photo J: Dry-fit the legs and seat and set a sliding bevel for the first stretcher socket in a leg.

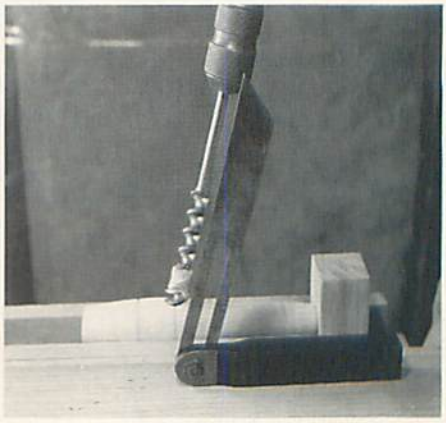


Photo K: Bore the stretcher socket, checking the angle against the bevel. To hold the tapering leg steady in the vise, insert the tenon in a piece of wood that is the same width as the leg's largest diameter.

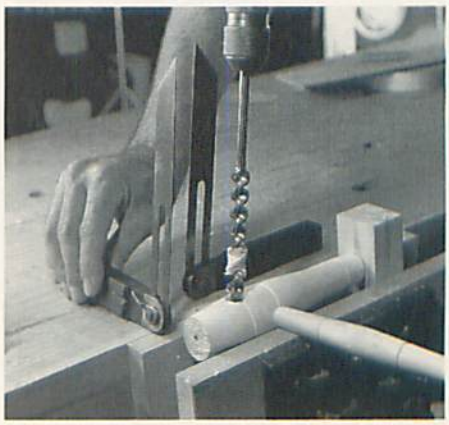


Photo L: Use two bevels to bore the second sockets in each leg.

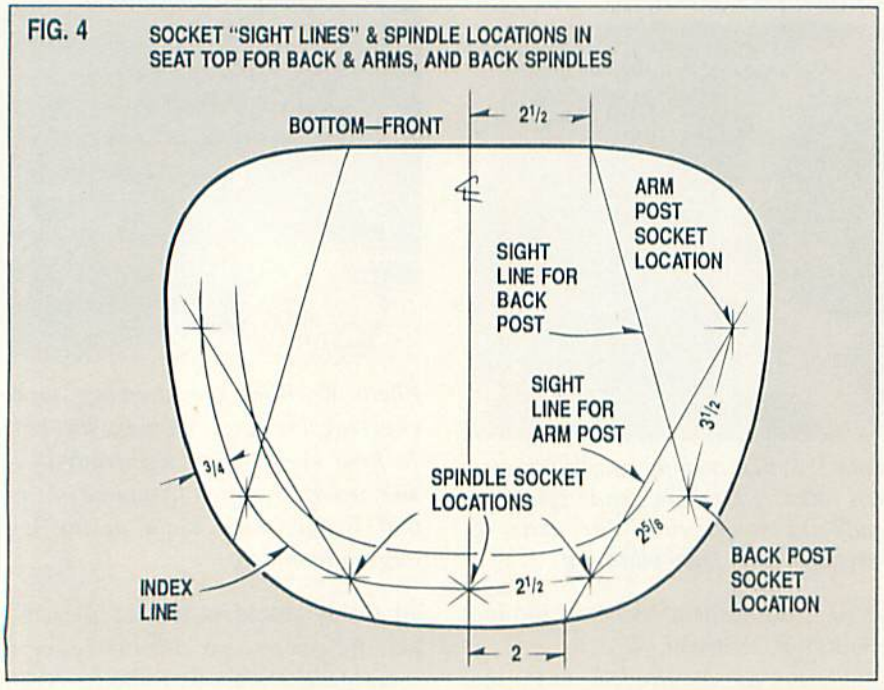
on the chair's back and arms.

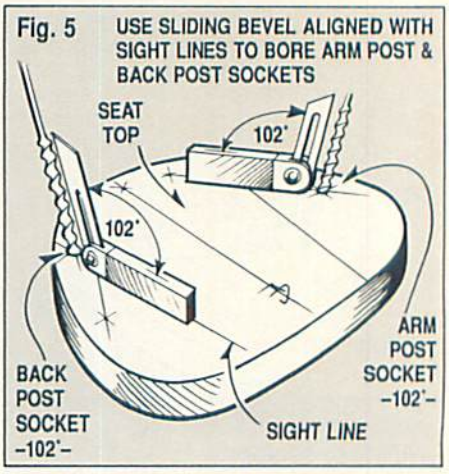
The Chair Back and Arms

You can turn all the parts for the chair back at the same time. Add a little extra length to the arms and don't cut the tenon shoulders yet—you'll determine their positions after socketing the arm posts and back posts into the seat. The thin spindles are a challenge to turn. If you can't get the hang of it, shape the spindles with a spokeshave.

First, lay out the socket locations for the arm and back posts, and for the spindles. The sockets are all aligned on a line 3/4 in. from the seat edge (Fig. 4). Set a compass to 2 1/2 in. and use it to lay out the two outside back spindles (Photo M), then measure up 2 5/8 along the 3/4 in. perimeter line to get the back post location, and 3 1/2 in. from that point to locate the arm post. Bore the sockets for the back posts and arm posts, using sliding bevels and sight lines as for the leg sockets (Photo N). These sight lines are shown in Fig. 4, the angles in Fig. 5. These sockets go through the seat; clamp a piece of scrap on the seat bottom to prevent tearout as the bit emerges. (If you're using green wood, dry the post tenons, then turn them to fit.)

The back rail is slightly curved along its length, easily done with a spokeshave. The rail tapers at both ends into tenons whose shoulders are on the rail's rounded top edge. Insert the back posts in their sockets and mark the length of the rail. Chop the mortises in the back posts, and shave the rail ends to fit.





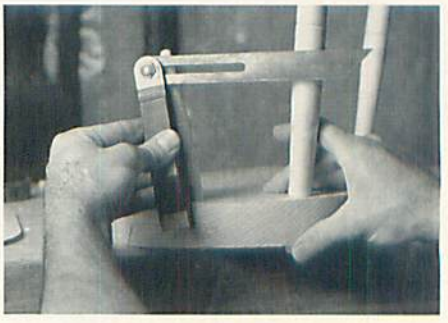


Photo O: Set a sliding bevel for the angle of the arm-post socket in the arm.

Dry-assemble the arm posts, back posts and back rail, set a bevel to the correct angle for the arm-post socket (Photo O), then bore the hole in the arm. Slip the arm in place, mark the position of the socket on the back post, and mark the shoulder for the arm's tenon (Photo P). Set a bevel to the correct angle, bore the sockets in the back posts, and turn a

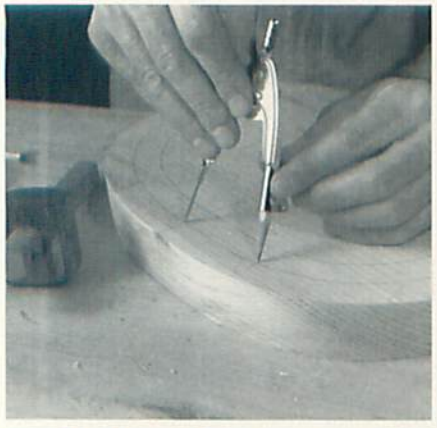


Photo M: Lay out back and arm post, and spindle locations along 3/4 in. perimeter line.

Photo N: Bore sockets for the arm and back posts, aligning the sliding bevel on the sight lines.

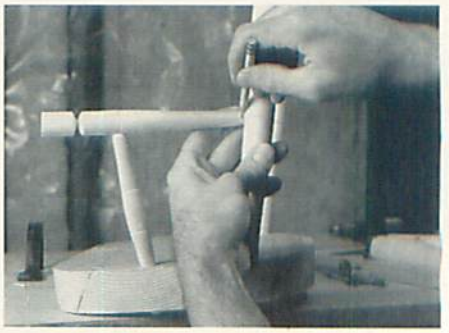


Photo P: Mark the position of the tenon shoulder on the arm.

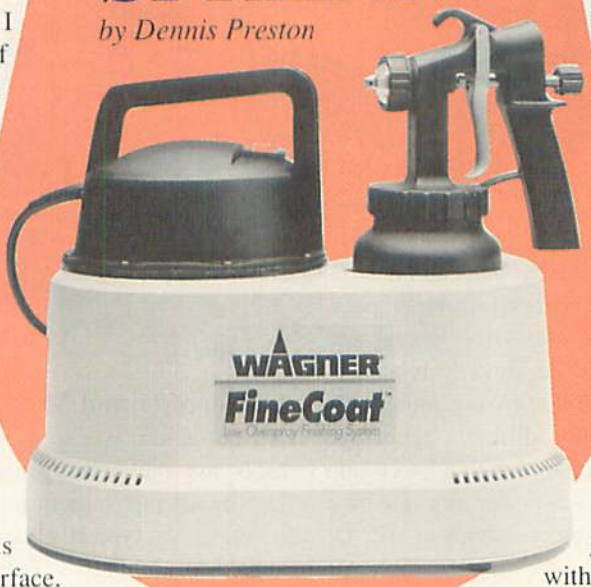
(continued on page 73)

New Product Review

WAGNER FINECOAT SPRAYER

by Dennis Preston

Spray finishing can help impart a real professional look to your projects and increase your efficiency on large finishing operations. I've had an air compressor for some time, but I've never used it for spraying. Lacking enough space for a dedicated spray area means that I would have to spray in the middle of my small shop. And it's the thought of the clouds of overspray covering everything else in the shop that has really prevented my enthusiastic leap toward spray finishing. With that in mind, I was really interested in the new Finecoat high volume low pressure (HVLP) sprayer from Wagner.



Why HVLP?

High transfer efficiency is the main selling point of HVLP. Transfer efficiency is the percentage of the finish sprayed that is actually deposited onto the work surface. Conventional spray guns require high pressure (about 40 psi @ 8 CFM) to atomize and propel the finish onto the work. The pressure produces very fine atomization, causing a large portion of the finish to remain airborne. Overspray is the airborne finish that settles elsewhere.

Instead of pressure, HVLP sprayers use high volume air flow and low pressure (about 4 psi @ 47 CFM from a shop vacuum type blower) to produce a fine mist. This results in less overspray and more finish ending up where you want it.

Because of the low pressure, HVLP systems are intended for use with light bodied (low viscosity) finishes. These include stains, water based varnishes, lacquer, and thinned polyurethane and enamel paints.

The Finecoat

The Finecoat comes complete in one package that includes the blower unit, a 15 ft. hose, the spray gun, viscosity cup, blower nozzle and instructions. The instructions are clear and, if you need assistance, there's also an 800 number help line available.

After reading the instructions, I swept up a 6 ft. by 6 ft. area to try the sprayer. Because the air delivery (and noise level) is like a shop vacuum exhaust, you should remove as much shop dust as possible so that it isn't blown onto the work.

There are two adjustments on the spray gun: a knob that controls the amount of fluid flowing to the nozzle, and the orientation of the spray cap, which determines the pattern. You can select a round pattern, or a vertical or horizontal fan pattern.

Let Us Spray

To prevent clogging the nozzle, I strained each finish and checked the viscosity before pouring it into the spray gun container. The *stain* and the water-based varnish didn't require thinning, but the solvent-based polyurethane needed to be thinned with mineral spirits before use.

In general, coverage and uniformity are dependent on your spray technique. It's important to keep the gun moving at a uniform rate and to always hold it perpendicular to the work surface. To further control the coverage and limit overspray, you can hold the nozzle from 1 to 12 in. away from the surface. Most of my testing was at about 12 in. from the work.

After some trial tests on cardboard to get the feel of the sprayer, I shifted to wood. To test the pattern uniformity, I sprayed water stain onto a pine board. The stain, actually an aniline dye, is one of the most difficult stains to apply without lap marks and blotchiness. The results were very good—better than I could have done with a rag in the same amount of time.

I next tried Carver-Tripp SuperPoly water-based polyurethane. The results were also very good. The fan pattern helps deposit a uniform layer with little overspray.

After a quick water clean up and thoroughly drying the spray gun I tried solvent-based polyurethane varnish. After thinning the polyurethane with mineral spirits and adjusting the material flow knob, I tried test patterns on some pine and oak. The polyurethane sprayed neatly and covered well but did not level as quickly as the water based poly. This may either be the nature of the varnish or that I didn't thin it enough.

Although the Finecoat will also spray conventional lacquers, I'd recommend staying with the clean water-based finishes to avoid the combustibility and health hazards of lacquers.

Clean-Up

Only the gun requires cleaning. Dump the remaining finish back into the can. Wash out the container and nozzle with the appropriate solvent. I'd prefer a larger opening in the mouth of the material container to make it easier to clean with a rag. The water-based finishes were the easiest to use and clean up.

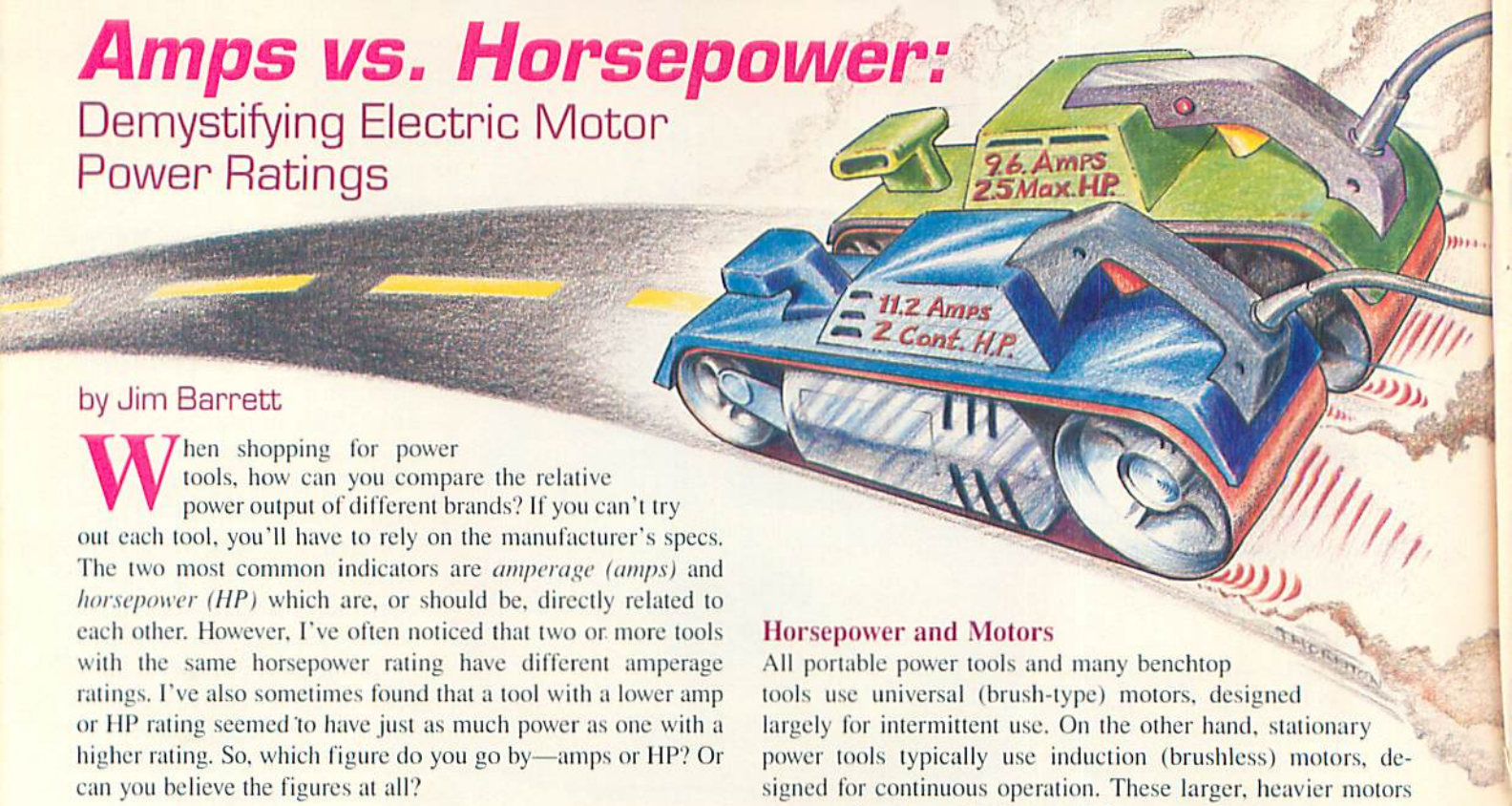
Summary

I was impressed with the Finecoat. It provided good uniformity and control. There was no detectable overspray beyond my cardboard backstop. While most of the Finecoat system is plastic (except for the nozzle assembly), because of the low pressure nothing seems to be highly stressed, so it should give long service.

For more information, contact Wagner Spray Tech Corporation, 1770 Fernbrook Lane, Minneapolis, MN 55447; tel. 1-800-328-8251. The current price is $179.

Amps vs. Horsepower:

Demystifying Electric Motor Power Ratings



by Jim Barrett

When shopping for power tools, how can you compare the relative power output of different brands? If you can't try out each tool, you'll have to rely on the manufacturer's specs. The two most common indicators are *amperage (amps)* and *horsepower (HP)* which are, or should be, directly related to each other. However, I've often noticed that two or more tools with the same horsepower rating have different amperage ratings. I've also sometimes found that a tool with a lower amp or HP rating seemed to have just as much power as one with a higher rating. So, which figure do you go by—amps or HP? Or can you believe the figures at all?

Assigning HP Ratings

To establish HP ratings for tools, most manufacturers attach the tool to a dynamometer. This device measures changes in motor speed and torque as an artificial *load* is applied to the tool by the dynamometer's brake until the motor stalls (lock-rotor torque). Speed and torque readings are taken at various points between the motor's *no load speed* at startup and motor stall. From these readings, a *horsepower curve* can be calculated, using the following basic formula: Speed (in rpm) x torque (in inch pounds) x .0000158 = HP.

While the formula itself is simple enough, many variables enter the picture, which can affect test results. And, because toolmakers test their tools independently of one another, there's no common yardstick or established procedure for rating HP in the tool industry. Also, the resulting data is sometimes tweaked a bit to rate a tool a bit higher—or lower—than it's actual power output, for various marketing reasons. One example of this is rounding out to the nearest HP—who ever heard of a $1^{15}/_{16}$ HP router? Finally, when comparing horsepower, you have to make sure you're looking at horses of the same color.

Two Types of Horsepower: Peak HP (also called maximum developed HP) is the top HP a motor can deliver for brief periods under a heavy load, such as when plowing through a dense knot in wood. At peak HP, the motor may draw over three times it's rated safe amperage, and after about 20 seconds, the motor will start to overheat (if you don't pop a circuit breaker first). Continuous HP (rated HP) is the amount of HP a motor can deliver during continuous operation without overheating; in other words, when the tool is operated for hours at a time at it's rated safe amperage.

Horsepower and Motors

All portable power tools and many benchtop tools use universal (brush-type) motors, designed largely for intermittent use. On the other hand, stationary power tools typically use induction (brushless) motors, designed for continuous operation. These larger, heavier motors run at a fixed speed (either 1,725 rpm or 3,450 rpm), and are able to chug along at this speed under a wide range of loads. Universal motors, on the other hand, can reach speeds as high as 25,000 rpm, but will slow down considerably under load.

As a rule, the nameplates on induction motors list continuous HP, although some tool makers also include peak HP in their literature. They usually don't assign HP ratings to tools with universal motors. Routers and some bench-top stationary tools are exceptions, typically giving peak HP ratings. If you're not sure which figure you're looking at when comparing tools, check the amp ratings: a rule of thumb is, a tool rated at 12 amps (at 120V) produces about $2^1/_2$ peak HP, or 1 continuous HP.

Amperage

The rated amperage of a tool is the maximum amount of current it can draw without overheating and burning up. Because the ratings are assigned by Underwriters Laboratories, which uses consistent test methods, amps tend to be a more accurate indication of actual motor power than HP. Even though amps are a measurement of electrical input, they reflect power output. Amps also tend to be a more precise measurement because they're usually broken down in $^1/_{10}$ increments (9.2 amps, 9.3 amps, etc.), whereas HP is usually broken down into $^1/_4$ increments ($^1/_2$ HP, $^3/_4$ HP, 1 HP, etc.). This is one reason why you'll sometimes see two different tools with the same HP rating, but with different amp ratings.

If you're still not sure whether amps and/or HP are an accurate indication of power, there's one more indication: the size and weight of the motor itself. Generally, the bigger and heavier a motor is, the more power it has. (As unscientific as this may sound, several electrical engineers concur.)

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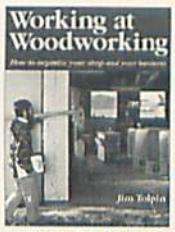

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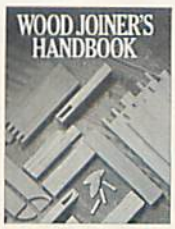

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Vacuum Turning

by Nick Cook

Shop-built vacuum chuck makes it easy to hold small parts

Nick Cook, a production woodturner from Marietta, Georgia, uses a variety of creative workholding devices to turn multiples. The use of a vacuum chuck makes it easy to quickly mount and release items like the trivets, yo-yo's and pocket mirrors shown here. Using a salvaged compressor, Nick shows how you can make a low cost vacuum chuck for your lathe. Once you have a vacuum source, it is easy to employ it for other uses, such as veneer clamping or holding small pieces for routing.

Although this article details chucks used to turn the three projects shown here, there is really no limit to the uses for a vacuum chucking system. All that's really needed is a flat surface on which to mount the workpiece, so there will be a good tight vacuum. The projects shown here are small, but Nick points out that the system is also ideal for larger pieces. You'll need a larger chuck to create a larger vacuum surface, but since the holding power of the vacuum system increases as the vacuum area is increased, heavier pieces are just as easily held.

Nick designs his chucks to automatically center his workpieces, which is important for things like the yo-yo's. But if you're only making one or two of an item, or just want to have fun experimenting with a block of wood, it's fine to just eyeball the workpiece as you mount it to the vacuum chuck. If the piece isn't perfectly on-center, it will quickly be centered as you turn it down to size. You can even reverse the vacuum system, feeding it through the inboard side of the headstock, for outboard turning work.

The use of a vacuum for holding and clamping is not new to the woodworking industry. Vacuum equipment has been used for years in industrial applications for holding work to be drilled, shaped, carved, assembled and sanded. In operation, a vacuum system can provide a versatile, hands-free method of holding most any size and shape of work. A foot switch makes the system even more convenient.

Recently, vacuums have made their way into smaller furniture and cabinet shops. They're even showing up in the home workshop. The introduction of less expensive vacuum pumps, in addition to venturi conversion kits for air compressors (the same compressor that you may already own and use for powering air tools or spray-painting equipment), have made the use of a vacuum even more attractive to many woodworkers. It's very effective for clamping, veneering and holding templates for routing, shaping and sanding.

And, as we shall see, the use of a vacuum chucking device on the lathe can also prove to be very beneficial. It saves time as well as providing a fastener-free chucking system. It allows the turner to hold various parts to the lathe without using screws, the tailstock or any of the many mechanical chucks. Most of the mechanical attachment methods require screwdrivers, wrenches or, at the very least, the moving of the tailstock. Even using hot-melt glue or double-faced tape requires the additional steps of application and removal.

Once a vacuum system has been set up, the vacuum chuck needs only a bleeder valve or switch to attach and release the work to and from the chuck. Either can be controlled by a footswitch, permitting hands-free operation. Although a vacuum chucking system isn't ideal for all types of turning work, for small, difficult to mount shapes—like the yo-yos, pocket mirrors and trivets, it's certainly the best way to go. It's also a great way to mount plates, bowls or any other workpiece that has a flat area to which a vacuum can be applied.

Vacuum Sources

The woodworker looking to set up a vacuum system has three options available. Commercial and industrial vacuum pumps can be purchased from industrial supply houses, for as little as $200 for a small 1/8 horsepower unit, up to several thousand dollars for larger systems. Or, you can purchase a venturi valve kit, such as the one available from Quality Vacuum Products, Inc. (see Sources),

that enables you to utilize your own compressor (1/2 horsepower or larger) as a vacuum source. The venturi valve kits range in price from $99 to $124. Finally, if your budget is tight, you can utilize a compressor from an old refrigerator or freezer (Photo 1) to build your own super low-cost vacuum system.

I've chosen the latter method, and the result is, in my opinion, as effective a vacuum system as had I mortgaged the house to buy a top-of-the line commercial system. First, though, some words of caution. By the time you read this a new law will have taken effect (section 608 of the Clean Air Act). The new law "prohibits the release of refrigerant into the atmosphere during the maintenance, servicing and disposal of refrigeration and air conditioning equipment beginning July 1, 1992." Please don't run downstairs and tear that compressor out of the old refrigerator in your basement. If you want to use your old appliance compressor, have a licensed serviceman handle the removal for you. If he's following current recommendations, he should recycle the refrigerant (which contains ozone depleting compounds) instead of venting it into the atmosphere. If you don't have an old refrigerator, you can buy a used compressor ($10 to $35) from an appliance service center.

What You Will Need

In addition to your vacuum source, you'll need tubing and a variety of fittings. Sizes and lengths will be determined by the source of your vacuum. For the system described here, we've used 1/4 in. brass and nylon tubing and compression type fittings. They are readily available and don't require any special tools to make connections.

You'll also need a ball bearing to prevent your tubing from spinning in the lathe spindle. I use a router bit bearing (about $5). Select a bearing with an inside diameter that matches the size of the tubing you'll be using. The outside diameter can be anything, as you'll inset it into a wood block handwheel. Our bearing is 1/4 in. ID and 3/4 in. OD. If you'd rather not track down the bearing and other parts, or make a handwheel, a kit is available (see page 32).

Photo 1

Although not absolutely necessary, a foot switch (Photo 1) makes this chucking system a lot more convenient. It can be as simple as an ON/OFF switch that your compressor connects to.

Getting Started

The first thing you'll want to do is decide how you are going to run the vacuum line through the headstock spindle. You must have a hollow spindle to start with. The one described here is the Delta Heavy Wood Lathe. It has a hollow spindle with a No. 2 Morse taper on the inboard side. The 1 in. spindle is threaded on both the inboard and the outboard side, so it accepts Delta's 6 in. faceplate, threaded for both inboard and outboard turning. Any similarly configured lathe can be set up for vacuum turning using the system described here.

As shown in Fig. 1, the vacuum chucking system I use is basically just a vacuum line mounted through a bearing let into a handwheel on the outboard side of the headstock, with your workpiece mounted to a chuck on the inboard side. The handwheel is very useful in stopping the lathe and turning the spindle for inspecting your work during production turning, which is why I've included it.

Make the Handwheel: First up is turning the handwheel. I started with a piece of 1 in. thick maple and cut a round about 9 in. in diameter. Mount the round to the 6 in. faceplate with 3/4 in. by no. 12 Phillips head sheet metal screws. I use sheet metal screws for all faceplate mounting; they don't require pilot holes and can be used over again. A power screwdriver speeds the process. Be sure to layer a generous coat of Vaseline on the handwheel surface that faces the faceplate. This prevents vacuum leaks when the system is in use.

Next, attach the faceplate to the inboard side of the lathe, and position the toolrest just below the center line, parallel to the axis. Set the lathe speed at approximately 1200 rpm, then rough turn the blank round and roll the edges to create a bullnose. Move the toolrest to the face of the blank and make a shearing cut across the face to finish it off. Both the preceding cuts were made with a 3/8 in. deep fluted bowl gouge but, if you feel more comfortable with scrapers, they will provide the same basic results. Next, mount a drill chuck in the tail-stock and drill a 3/8 in. hole through the wood blank.

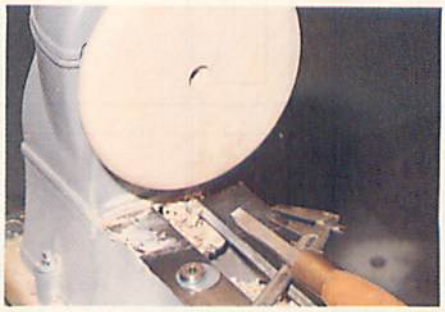


Photo 2

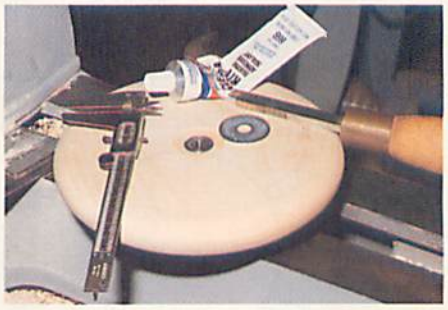
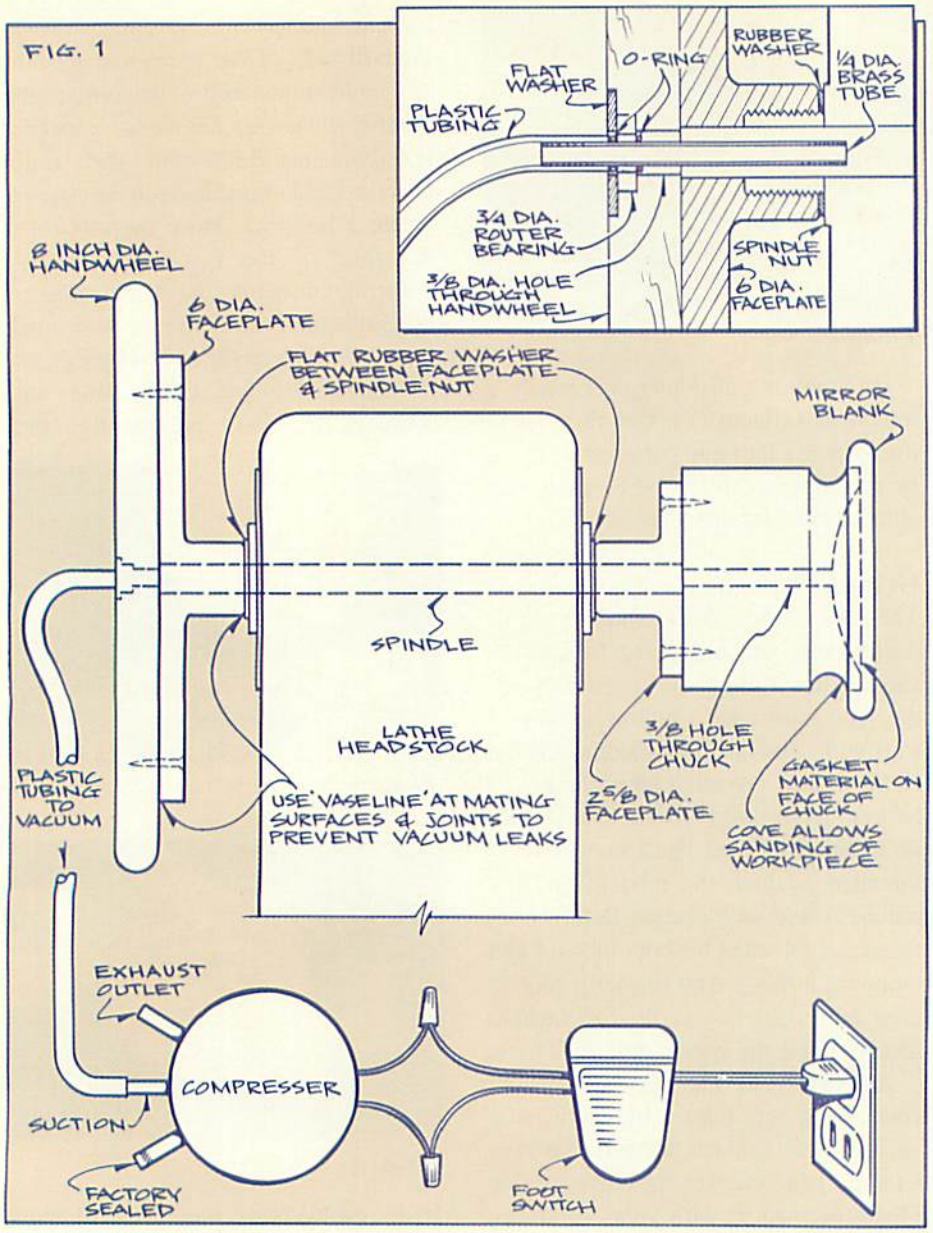


Photo 3

It is important that the router bit bearing fits properly into the handwheel. Our bearing is 3/4 in. diameter and 1/4 in. thick. Using a 1/2 in. square scraper, cut a recess in the center of the blank to accept the bearing (Photo 2). It needs to be a press type fit so measure carefully (I used calipers) and test-fit frequently. Recess the bearing just below the surface of the wood, then cut a second recess to accept an oversized washer to act as a retaining ring. Photo 3 shows how the bearing fits into its recess, with the recess for the retainer washer, and the calipers that I use to check the recess sizes as I turn them. Also shown is the silicone sealant.



Assembling the Vacuum System

Although at first glance the mounting system that feeds the vacuum to the workpiece through the headstock may seem complicated, it's really quite simple. Keep in mind that the whole idea here is to keep the vacuum tube feed assembly stable; the handwheel and spindle are revolving around it.

The key to allowing the handwheel and spindle to revolve around the vacuum tubing is the way the vacuum tubing is mounted in the handwheel. You'll need a 4 in. length of brass (or copper) tubing, that fits as tightly as possible through the router bearing. You'll also need a pair of rubber O-rings, two flat rubber washers, a metal retainer washer and some silicone sealant. Bring the router bit ball bearing with you to the hardware store so you get the right size brass tubing, O-rings and metal washer. A snug fit of the brass tubing in the router bit ball bearing is essential for the tubing to be centered within the handwheel and spindle. The flat metal retainer washer should be sized so its inside diameter is large enough to also clear the rubber O-ring. The purpose of this washer is only to hold the bearing in place, and the outermost O-ring should not chafe against it. Note that the ⅜ in. diameter hole through the handwheel allows clearance for the innermost O-ring, so it also doesn't chafe.

Mounting the Brass Tubing: To mount the brass tubing, first slide one of the O-rings onto the 4 in. length of tubing, followed by the router bearing and the second O-ring. The O-rings and bearing should be positioned on the tubing as shown in Fig. 1, so the tubing will extend well into the spindle. Slide the tubing/O-ring/bearing assembly into the handwheel, so the bearing press-fits within its recess, then slide the retaining washer over the tubing, and bed it into a bead of silicone in the handwheel's washer recess. Take care not to get any silicone on the bearing, the O-ring or the tubing, since the handwheel must turn freely around the tubing/O-ring assembly. Later, when you slide your vinyl/nylon vacuum line over the end of the brass tubing, you can butt the tubing right up to the outermost O-ring.

Mounting the Handwheel: To mount the handwheel to the spindle, just screw it onto the threaded spindle end on the outboard side of the headstock. Be sure to include a flat rubber washer between the faceplate and the spindle nut, and apply some Vaseline to the spindle threads, also to prevent vacuum leaks.

Preparing the Compressor

The Electrical Connection: If you're using a salvaged compressor for your vacuum source, here's what you'll have: The compressor itself is typically a dome-shaped sealed unit (Photo 1). Since the compressor is usually wired into a fuse box in the back of the appliance, there won't be an electrical plug on the compressor. Instead, you'll see a pigtail pair of electrical leads. Although you can wire these leads into an ON/OFF switch, and then run an electrical line and plug from the switch to a wall outlet, a better choice is to wire a short lead and plug onto the pigtails, connecting the compressor to a foot switch that then plugs into a wall outlet (Fig. 1). With vacuum turning, a foot switch is very convenient. When making the electrical connections, just be sure to use wire nuts or another approved electrical connection, and wrap your connections securely with electrical tape. Careless wiring can cause a fire or result in electrical shock. If you aren't

experienced in electrical work, have a licensed electrician do it for you.

Identify The Vacuum Tube Connection: Once again, look your salvaged compressor over. You should find three copper tubes extending from the compressor housing. One tube will have its end crimped shut and solder-sealed. The two other tubes are, respectively, the vacuum suction and the exhaust. By plugging the unit in, turning it on, and placing your finger over the two tubes, you should be able to quickly determine which tube is sucking air in—that's your vacuum. Once you've identified the suction tube, mount the compressor to a board or within a box, so that once you've got it set up for operation, it doesn't have a tendency to "walk" or move around.

Connecting to the Compressor

Finally, run a vinyl or nylon vacuum line from the brass tubing extending out from the handwheel (Photo 4) down to the vacuum suction tube on the compressor. You'll need a fairly thick-walled vinyl or nylon tubing to serve as your vacuum line (thick enough so you can't press the tubing closed with your fingers). Don't use a thin-walled tubing, since the vacuum will collapse it.

A combination of couplers may be needed to attach the vacuum line to the brass tubing on the handwheel, and to the compressor. Hose clamps and Teflon tape also come in handy here. However, with a little luck, you should be able to find a plastic tubing that just slides neatly over the brass tubing, without any additional mechanical connection needed. A little Vaseline on the connections always helps provide a tighter seal.

With your vacuum line in place, test that the handwheel/spindle rotates freely around the vacuum tubing. Turn the handwheel by hand. The weight of the tubing feeding down to the compressor should supply enough resistance so the tubing feeding through the handwheel doesn't also turn. Now turn the lathe on to check that everything is still stable with the lathe up to speed.

As a final test, with the lathe turned off, turn on the compressor and check the system for vacuum leaks. Use Teflon tape to eliminate leaks on threaded parts.

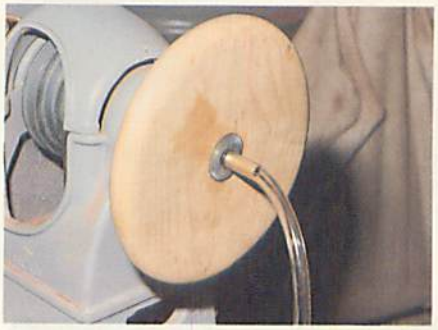


Photo 4

The mechanical part of your vacuum system is now complete.

Vacuum Chucks

As shown in Fig. 1, on the inboard side of the headstock, you'll need to mount a chuck to hold the workpiece, employing the vacuum that you've fed from the compressor and through the handwheel and spindle. Although you'll need to make a separate chuck for each different project that you intend to make (unless two or more items share the same rough diameter or vacuum clamping recess), the principles used in making the chucks are similar. Since two of our three projects (the trivets and pocket mirrors) share the same recess diameter, we only need two different chucks to make them.

All vacuum chucks are basically just blocks of wood, mounted to a faceplate, drilled through for the vacuum feeder airway, and dished to a concave recess on the end, so the vacuum suction is spread over a maximum area of the workpiece. The faceplate is mounted to the chuck with sheetmetal screws, like those used to mount the 6 in. faceplate to the handwheel and, like that assembly, a generous layer of Vaseline on the area where the parts meet insures a leak-free vacuum. As with the handwheel faceplate, a rubber flat washer between the faceplate and spindle nut also helps prevent vacuum leaks.

Once you've sized the chuck to fit your workpiece, drilled through it for the vacuum airway, and turned the concave recess on the end, you'll need to find a way to insure that there's no leakage with the workpiece on the chuck. Since the only thing that's holding the work-

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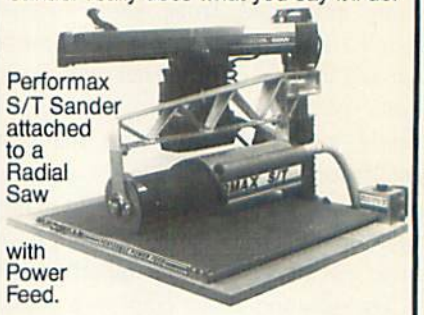

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piece onto the chuck is the suction that's being produced from your vacuum source, you'll need to make certain that the surface where the chuck and workpiece meet is gap-free. However, it would impossible to expect that you could accurately—and easily—produce gap-free surfaces in the shop. No matter what tooling and expertise you have, there will always be some imperfections.

The solution is to employ a gasket between the chuck and the workpiece to insure the vacuum seal. No matter what you plan on turning with a vacuum chuck, you'll need to include a gasket on the chuck to insure a good tight vacuum seal. I've found that closed-cell neoprene rubber is the best material. Check the telephone book yellow pages under rubber products, foam, or sponge rubber, or you can obtain the gasket material from me (see Sources). Thin, soft, sheet-styrofoam packing material (Photo 5) also works great as a gasket material.

Cut out a circle of the gasket material, cut a hole through the center for the vacuum airway, then use rubber cement, contact cement, or a spray adhesive to apply the gasket to the chuck (Photo 6).

The faceplate/chuck assembly screws onto the inboard end of the spindle. As with the handwheel/faceplate on the outboard side, make sure it's tight against the rubber washer, and apply some Vaseline to the spindle threads.

Making the Mirror/Trivet Chuck

As noted earlier, the pocket mirrors and trivets share the same chuck. Both projects feature a 1/8 in. deep by 3 1/16 in. diameter recess. On the pocket mirrors the recess accepts the mirror glass; on the trivets, the recess becomes the trivet's foot. The chuck is sized so that it fits within this recess in the pocket mirror/trivet blanks (Fig. 2). The fact that the chuck fits the recess serves to automatically center the workpiece. Although you could just eyeball a workpiece when mounting it on a vacuum chuck, by using a chuck and workpiece that allows the workpiece to be automatically centered, the amount of turning (and the time required) is minimized.

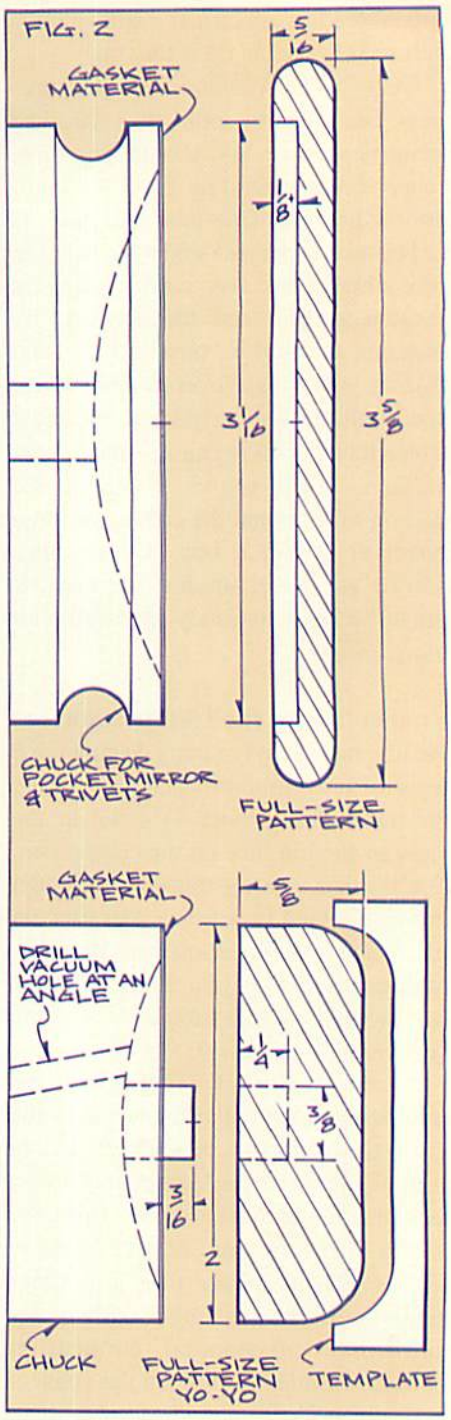
Start with a block of 2 in. thick hard maple, about 3 1/2 in. to 4 in. in diameter.

Photo 5

Photo 6

Apply Vaseline, then mount the faceplate (I use 2 5/8 in. diameter machined steel faceplates from Craft Supplies, USA; see Sources) to the maple chuck block. The faceplate must have a hole through it for the vacuum airway. Be sure to use all the screwholes through the faceplate, to provide a tighter seal and avoid vacuum leaks.

Mount the faceplate/chuck blank to the spindle, rough-turn to a cylinder, then turn down to the final 3 1/16 in. diameter size to fit the mirror/trivet recess. It helps to have one of the mirror/trivet blanks prepared at this point, so you can check your turning diameter and make sure it matches the mirror/trivet recess. Also, create the concave recess and the cove. The cove makes it easier to sand the edges. Drill through the maple block center with a 3/8 in. diameter bit for the vacuum airway, then cut and mount the gasket material, as described earlier.



Preparing the Mirror Blanks

I make all of my pocket mirrors from cocobolo, one of my favorite woods to turn, but you can select most any tight grained hardwood. I start with 4/4 in. thick x 4 in. wide stock and resaw and plane it down to 3/8 in. thick. Then I cut the blanks to 3 3/4 in. x 3 3/4 in. squares.

At this point, you can go one of two ways. If you only want to make one pocket mirror, cut the blank to a rough circle, mount it on the lathe and cut the recess for the mirror with a square

scraper. Check the fit with one of the mirrors and allow approximately 1/16 in. extra for wood movement. The recess bottom should be perfectly flat to provide the mirror with good support.

If you plan on making any quantity of the pocket mirrors, I recommend using a router and template method to make your recess cuts. I use a 3 1/2 HP plunge router fitted with a 3/4 in. template guide bushing (see Sources). A 3/8 in. straight cut carbide-tipped bit provides the best results. I have tried the spiral cut bits and they work very well for other applications but tend to tear out the grain on the mirror blanks. The template is made of 1/4 in. acrylic with a 3 7/16 in. dia. hole cut into it. My hole is sized to work with the 3/8 in. bit and 3/4 in. bushing, but the size of the hole will vary depending on the router bit and template guide you select. Trial and error might be the best way to determine the size of your template. The hole in the acrylic can be cut with a router or you can mount the acrylic to a faceplate and turn the template hole.

A fixture is clamped to the workbench and uses a pair of wedges to hold the blank in place (Photo 7). The template is now mounted over the fixture so as to hold the blank to be routed. A couple of pins or screws will hold the template in place during the routing (Photo 8). The mirrors I use are exactly 3 mm. (about 1/8 in.) thick and I set the depth of the cut to just over that. The results will be extremely accurate and consistent.

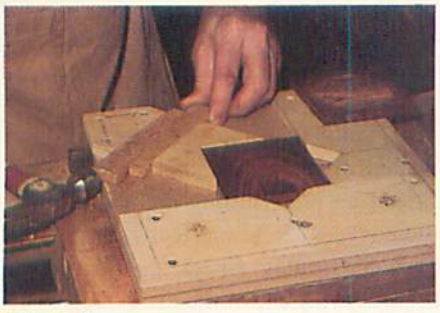


Photo 7

Photo 8

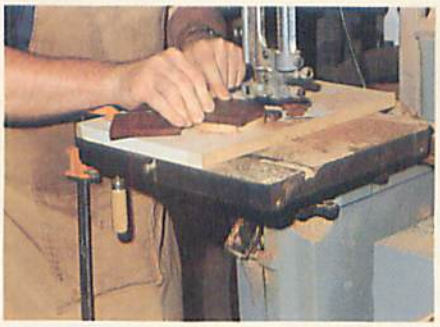


Photo 9

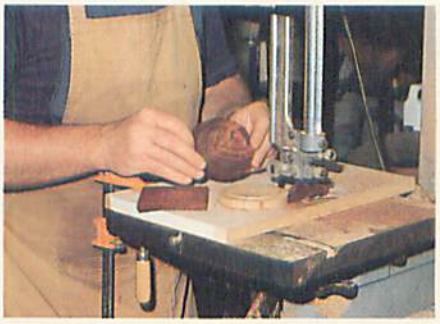


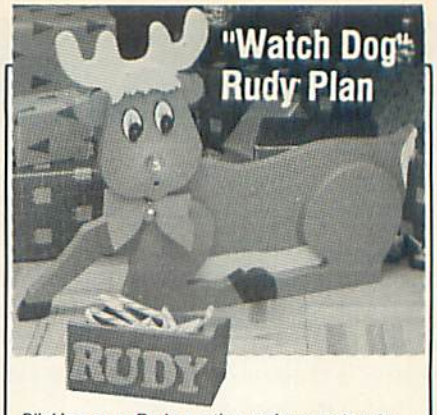
Photo 10

A large forstner bit is another time-saving way to make the mirror recess.

Once the recess is established, I cut the corners off the blanks on a jig set up on the band saw (Photo 9). The jig consists of a turned block that fits the mirror recess, fastened to a round wood spacer (Photo 10). The blank is rotated on the jig to cut off the corners. Using this method to rough the workpiece to round saves a lot of turning time.

Turning the Pocket Mirrors

With the mirror recess cut, position the blank over the end of your chuck and turn on your vacuum (Photo 11). It should draw the blank up tight to the chuck if everything is working right. Set the lathe speed at about 1200 rpm and start the machine. I use a 3/8 in. deep-fluted bowl gouge for most of the turning. With the toolrest parallel to the bed of the lathe and set just below the center, I start by turning the blank down to a perfect circle (Photo 12). Then, round over both edges to form a bull-nose shape. Before moving the toolrest, I use a spindle gouge ground to a long fingernail, or a skew to finish off the rim of the blank.



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I then position the toolrest 90 degrees to the bed and in front of blank. I make a light shearing cut across what will become the back of the mirror. This is done with the 3/8 in. deep-fluted bowl gouge (Photo 13). You can also use the point of a skew to cut rings in the wood for added decoration.

Once your turning is complete, start sanding with 220 grit paper, and continue through 320, and 400. Finish up with 600 grit wet-or-dry. Then use steel wool to apply paste wax, and finally buff with a soft cloth (Photo 14).

Remove the blank from the chuck. You may need to touch up the front surface with fine sandpaper at the recess rim. Then apply wax to the recess interior rim and buff. Wipe the flat recess bottom clean with a dry cloth to remove dust. Squeeze out a small dab of silicone adhesive in the center of the recess and press the mirror into place (Fig. 3, and Photos 15, 16). Avoid using too much adhesive, because if it squeezes out around the mirror, it is very difficult to remove. Set aside for several hours for the adhesive to fully cure. Do not use cyanoacrylate or any other rigid setting glue for bonding the mirrors in place. Use only flexible adhesives or a special mirror mastic.

Your mirror is complete. Add a suede or fabric drawstring bag (see Sources) and you will have a great gift. By the way, substitute cork (see Sources) for the mirrors, and you've got coasters instead of pocket mirrors.

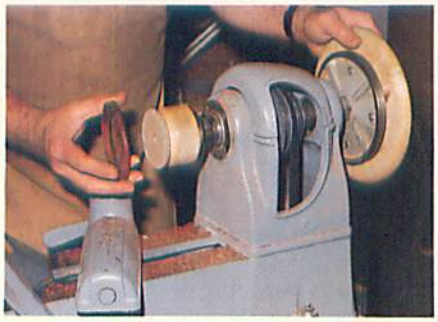


Photo 11

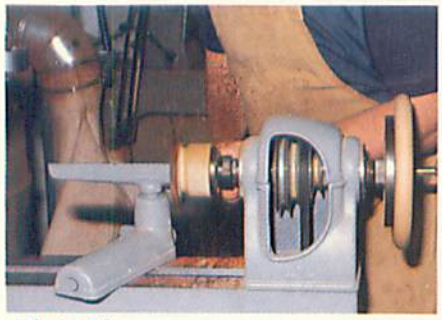


Photo 12

Photo 13

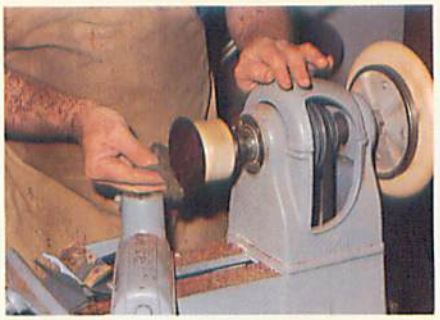


Photo 14

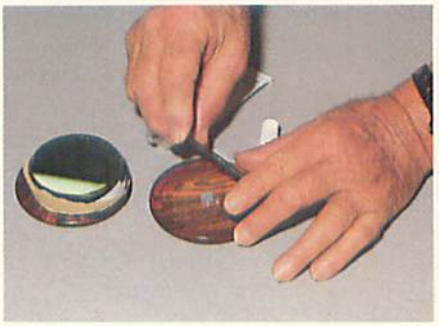
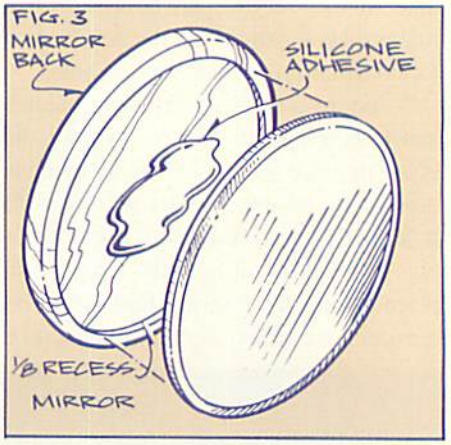


Photo 15

Photo 16

Photo 17



Making the Yo-Yo Chuck

The chuck for turning the yo-yo's varies slightly from the mirror chuck. Start out basically the same, with a small faceplate and a 2 in. thick block of hard maple cut to a 3 in. to 3 1/2 in. diameter. Attach as before with sheet metal screws and remember to spread Vaseline between the two. Rough turn to a cylinder using a gouge, then turn down to the exact diameter you intend to make your yo-yo's. Although I have made yo-yo's in various sizes, my production models are 2 in. to 2 1/8 in. in diameter.

Now you will need to turn down the face of the chuck to leave only a 3/8 in. dia. stub about 3/16 in. long (Photo 17). This stub fits into a like-sized hole drilled in the halves of the yo-yo (see Preparing and Turning the Yo-Yo), and thereby serves to perfectly center the parts for turning. Check the diameter of the stub with one of the drilled blanks to ensure a snug fit. Leave the rim of the chuck flat and hollow slightly toward the center. This recess in the chuck will provide better holding for the vacuum. Add the gasket material around the perimeter as with the previous chuck. With the stub for centering the blank, you will not be able to drill through the center as before. You will need to drill an angled hole through the yo-yo chuck to meet up with the hole through the faceplate (Fig. 2 and Photo 18). Take

care here. You may want to drill the hole prior to turning the chuck.

Preparing and Turning the Yo-Yo

You can, of course, utilize the scrap wood we all have a tendency to collect around our shops for your yo-yo's. However, if you intend to make any quantity of these, as I do, you will probably want to start out fresh. I start with 4/4 in. thick x 3 in. wide x 36 in. long cocobolo. Begin by resawing and planing the stock down to 5/8 in. x 2 1/4 in. strips. Next, you will need to set up a sliding table on the band saw and cut the blanks to 2 1/4 in. squares.

Drilling the blank is the next step. Purchase your 3/8 in. diameter dowels first, from a good reliable source to insure that they are perfectly round and true to size. Be careful to select a brad point drill bit to exactly match the size of your dowels. A 3/8 in. bit is not always exactly 3/8 in. Set up your drill press with a V-block on the table to accept the blank and align the bit to center the hole. Adjust the depth to 1/4 in. and drill the blanks.

Return to the band saw and cut the corners off the blanks to produce an octagon. I use a simple jig, as shown in Photo 19. Once again, this will help to reduce the time it takes to turn the finished product.

Photo 18

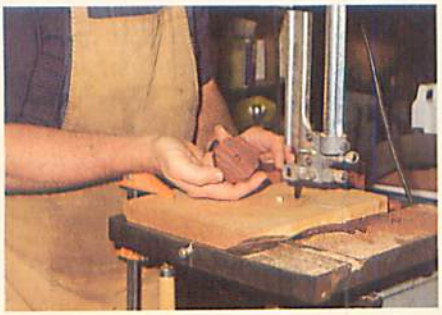


Photo 19

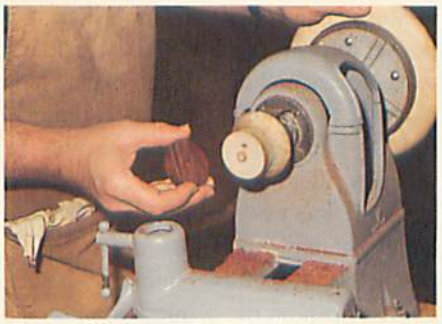


Photo 20

Photo 21

To turn the yo-yo blanks, first position the blank over the stub on your chuck and turn on your vacuum system (Photo 20). It should pull up tightly against the chuck. As before, I use the 3/8 in. deep fluted bowl gouge to do most of the shaping (Photo 21). Start by turning the blank down to just a bit larger than your chuck, then with a very light finishing cut, trim it down to the exact size. Now, using the same gouge, you can radius the outer edge of the blank. It can be most any size radius, but it is important that both halves of each yo-yo are identical. If one half is heavier than the other, then the yo-yo will be out of balance, and won't operate properly. You might want to make a template (Fig. 2) to check each half. Sand and finish the yo-yo blanks while they are still mounted on the chuck (Photo 22).

Cut your 3/8 in. dowels to just over 9/16 in. long. There should be a space slightly wider than the string once the blanks are put together with the axle. You may need to adjust axle length depending on the exact depth of the holes drilled previously. Assemble the two halves with a drop of cyanoacrylate adhesive in each hole (Fig. 4; Photo 23). Be careful not to use too much, as squeeze-out will interfere with the operation of the yo-yo. Add the string (see Sources) and you're ready to walk the dog and rock the baby.

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#10648 1" Wheel, 1/4" hole	5.50/100
#10710 1-1/4" Wheel, 1/4" hole	7.50/100
#10812 1-1/2" Wheel, 1/4" hole	10.50/100
#10914 1-3/4" Wheel, 1/4" hole	15.00/100
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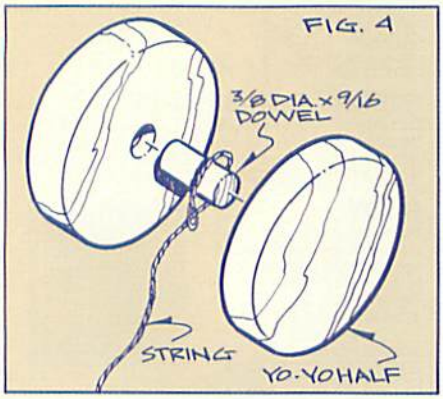

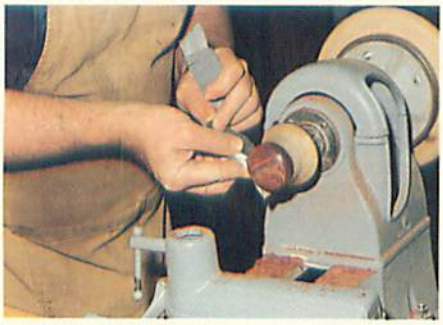

Photo 22

Photo 23

Turning Trivets

Another product suitable for turning on your new vacuum chuck is a round trivet. These can be made from most any type of wood and there are no rigid rules for their size or shape (Fig. 5).

Use the same template (for routing the recess) and chuck as for the pocket mirrors. Start by cutting various size circles from whatever scrap you have around the shop. They can be anything from 4 to 12 in. diameter. Thickness can be almost anything from 3/4 to 1 in.; you might even go down to 1/2 in. for smaller trivets. Use a compass to mark a circle the same size as your template on the bottom of each blank. This will make it easy to center the template on the blank.

Since each blank is going to be a different size, you cannot use the work-holding fixture that we enjoyed for the pocket mirrors. Instead, clamp the blank to your bench and use doublefaced tape to attach the template to your workpiece. Put the tape on the underside of the template, then remove the paper liner. Dust off the workpiece to ensure good adhesion between it and the template. Align the hole in the template with the circle drawn on the blank, and press the two together. Using the same router, template guide and bit that you used for the mirrors, route the back of the blank.

Use the mirror chuck to attach the blank to the lathe (Photo 24). You will need to reduce the lathe speed for turning larger trivets but about 1200 rpm should be fine for anything up to about 6 in. dia. Rough turn the trivet to round

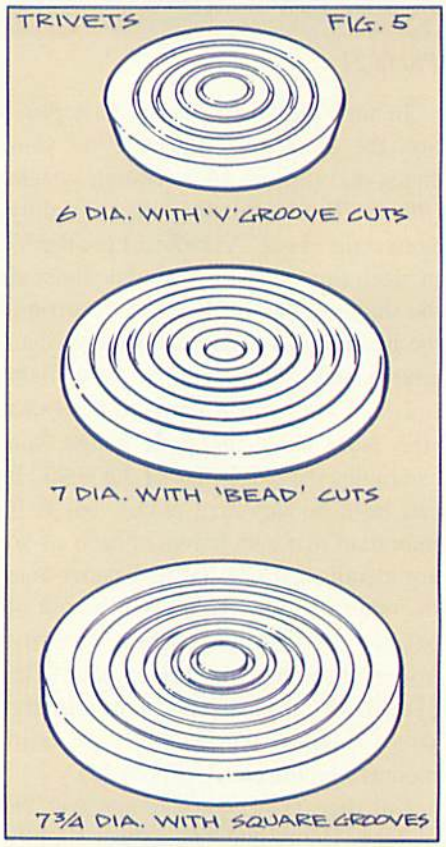

Photo 24

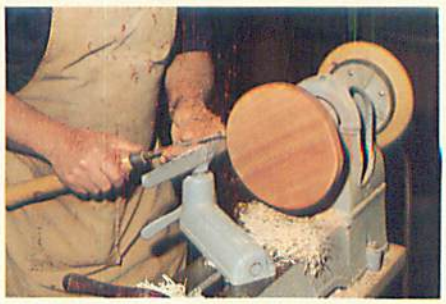

Photo 25

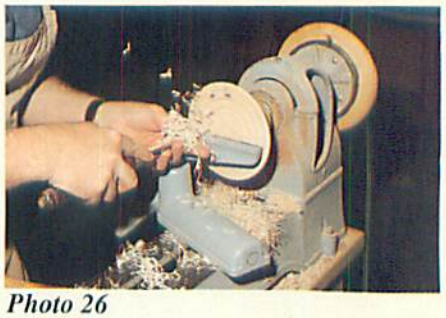

Photo 26

using the 3/8 in. deep fluted bowl gouge (Photo 25).

At this point, you are on your own, let your imagination run wild. You can create a variety of edge profiles. Try them all; bullnose, square, beveled or a combination of several. Also be creative with the face of your trivets, using beads and coves, or a series of rings cut with the tip of the skew (Photo 26). You can even just leave them plain and flat.

Sand the trivet with a power sander and by hand as required by the type of wood you are using. I usually stop at 320 or 400 grit. Finish with urethane oil (available from Craft Supplies, USA). Apply a liberal coat and let it penetrate for about 15 minutes, then wipe off the excess and let dry overnight.

Vacuum Chuck Kit

The EZ Vacuum Chuck kit contains a male quick disconnect coupler, a sealed ball bearing, a tapered hand knob for easy attachment of the vacuum source, a threaded tube which is adjustable to most spindle lengths, a nose assembly with vacuum vents and an adjustable or removable center point. List price for the EZ Vacuum Chuck kit is $49.95 plus S & H from The Turning Post, 619 North 2000 West, Ogden, UT 84404; tel. (801) 731-1036.

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1287 E. 1120 So.
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Early American *Classic* Pine Hutch

When it comes to utility, few projects can equal the multi-functional capacity of the hutch. In the living room, dining room, or family room, no piece better combines ample storage space with a generous display area.

The hutch shown has served in a variety of capacities, and in many different homes. Built some 30 years ago by Ted Thornton, now of Punta Gorda, Florida, the piece still sports its original finish. Although "aged" with the usual dings and scuffs, the pine's warm patina seems to only improve with the years.

Although we tend to think of large projects as being complex and difficult to build, the design of this hutch is probably as elemental as a large piece can get. Excepting the 1/4 in. plywood for the base section back and the drawer bottoms, all the board stock is just 3/4 in. thick no. 2 pine. The molding around the upper section is a common lumberyard crown molding.

Perhaps best of all, you don't need a shop full of costly equipment to build this project. When Ted Thornton built the hutch, all he had was a Shopsmith multitool, though a router would have also been helpful. Most of the work was accomplished using just the table saw; the Shopsmith scroll saw attachment was used to cut the classic whale-tail scroll profile in the upper section sides. A thickness planer isn't required.

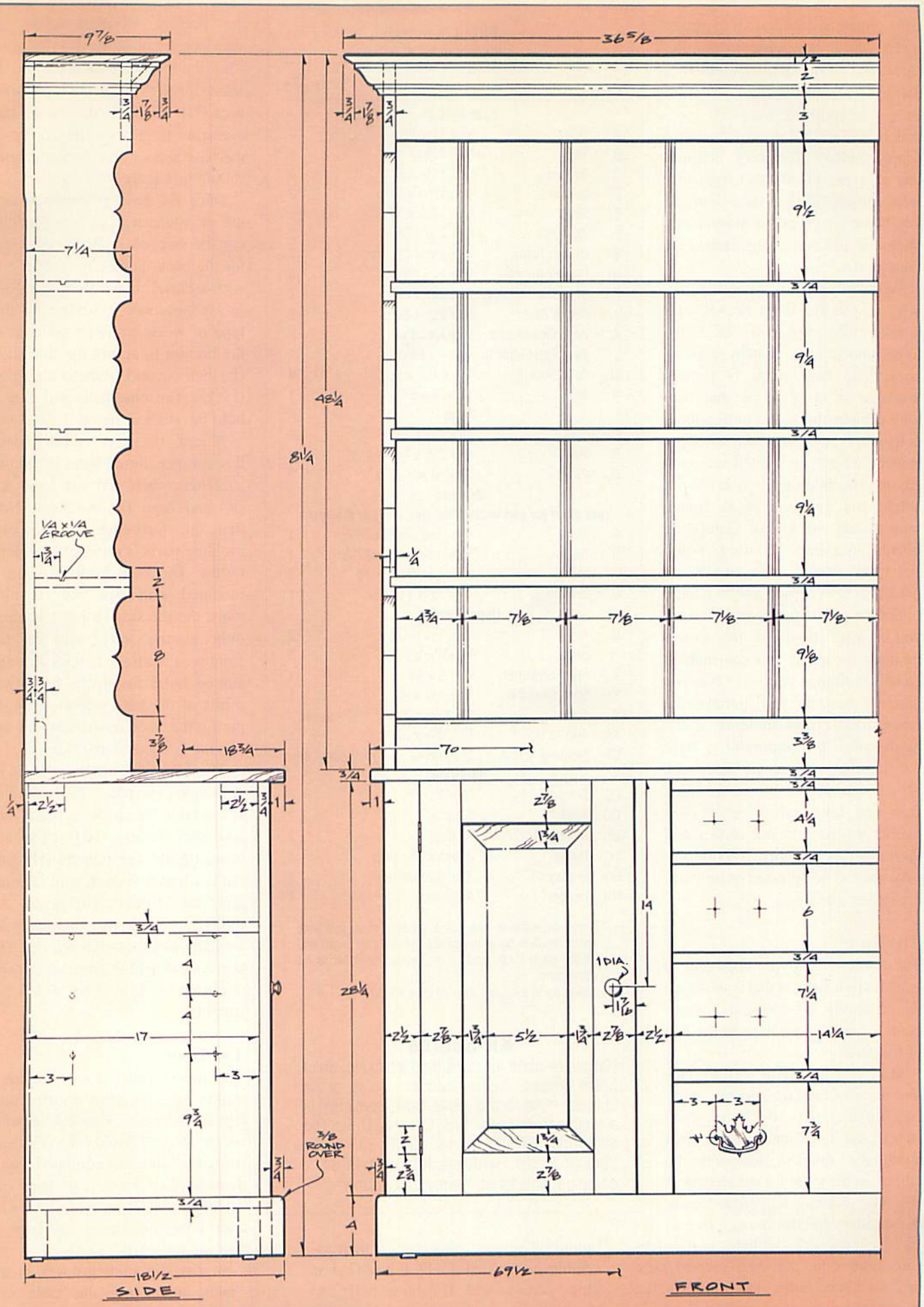
Unlike much large casework, if you aren't rich in clamps, you can still build this project. By purchasing pre-glued wide pine you won't need the array of pipe or bar clamps that edge-gluing work typically requires. And since parts are assembled with finish nails and screws, clamps aren't needed for the case and upper section assembly.

Most of the hardware shown is fairly common, but to make it a little easier for you to locate everything, we've arranged for a supplier to put together a kit (see Kit Source) that includes all the hardware that you'll need.

Buying Stock

By looking over the illustrations, and reviewing the Bill of Materials list, you'll note that many parts are sized to be obtained from common "1-by" pine boards. All the 2 1/2 in. wide parts, for example, can be obtained from 1 by 3 pine boards, which measure exactly 2 1/2 in. wide. And the 7 1/4 in. wide upper section sides and back boards can be cut from 1 by 8 pine boards, again, with no waste.

And, as noted earlier, if you don't like


SIDE
FRONT
1/4 x 1/4 GROOVE
3/8 ROUND OVER
1 DIA.

edge-gluing narrow boards to obtain wider parts, the wide parts—the sides (A), top (B), bottom (C), dividers (D) and shelves (E)—can be cut from pre-glued wide pine, which is now sold in most building supply centers. Just keep in mind that this pre-glued stock typically measures slightly less than 3/4 in., so you'll need to check the actual stock thickness before cutting dadoes for these parts.

When buying no. 2 pine boards, select carefully. Avoid boards with a noticeable cup, warp or twist, loose knots, or a blotchy appearance. The best stock is usually available at large yards that deal with cabinet shops and professional carpenters. Avoid consumer supply centers, where the limited selection has usually been well picked over. When you get your stock home, immediately stack and clamp the boards until they are used. When left lying around, pine boards are notorious for cupping and twisting.

Before starting construction, you'll want to have the crown molding on hand. You can make a crown molding yourself, but it's much easier to just purchase a ready-made crown molding at the lumberyard. It's important to have the molding on hand, since the actual size of the crown molding that your lumberyard carries will likely vary from the one shown, and the rabbet in the upper section top may need to be adjusted to properly accept the molding.

The Base

The easiest way to approach a construction such as this is to divide the assembly into logical components, exactly as we have in the Bill of Materials.

Start with the base section, cutting parts to final length and width. Lay out the 3/4 in. by 1/4 in. dado cuts in the sides and bottom, then notch the dividers and cut the rabbets in the sides for the stretchers (F). Also, cut the stopped dadoes in the dividers for the drawer frames (G). Drill the series of holes in the sides and dividers for the shelf support pins, drill the slotted holes in the sides and top stretchers for the base molding and top mounting screws, respectively, then assemble parts A, B, C, D, F and G. Use glue, screws and finishing nails, as shown in the exploded view. Note that the bottom, dividers and rear stretcher are positioned 1/4 in. inset from the back edge of the sides, to allow for the 1/4 in. thick plywood back (N). Check the diagonal measurements from corner-to-corner on the base section (the measurements should be equal).

Once the base assembly is dry, use the router with an edge guide to cut the stopped rabbet in the sides for the back. Square the rabbet end with a chisel. Use a sharp handsaw (a Japanese saw is perfect for this type of work) to notch the ends of the bottom to accept the side stiles (I), then cut and fit the center stiles (J). Use finishing nails and glue to hold the stiles in place.

Mount the top, screwing up through the slotted holes in the two stretchers, then add the base side (K) and front (L) moldings. Note that the top edge of the base molding parts is rounded to a 3/8 in. radius. The base front molding is mounted with glue and finishing nails, but the side molding is glued only at the miter and on the frontmost section. Screws through slotted holes fasten the back two-thirds of the base side molding, to permit the wood movement that will inevitably occur in the sides.

The foot blocks (M) are made by laminating two pieces of 3/4 in. thick stock. Glue the blocks in place, then add the levelers (HH). You can make the drawer runners (H) now, but don't mount them until later on, after the drawers are made. Although we show two shelves, make as many as your needs require. The shelves are held in place with 1/4 in. diameter by 1 in. long dowel pin supports.

The Doors

The raised panel doors feature a traditional slip joint construction. Rip sufficient stock to 2 7/8 in. wide for the stiles (O) and rails (P), then, using the table saw equipped with a dado head set for a 1/4 in. wide cut, establish the 1/4 in. wide by 3/4 in. deep panel groove on one edge of the stile and rail parts.

To cut the slip joint grooves in the stile ends, again use the table saw equipped with the dado head set for a 1/4

Bill of Materials
(all dimensions actual)

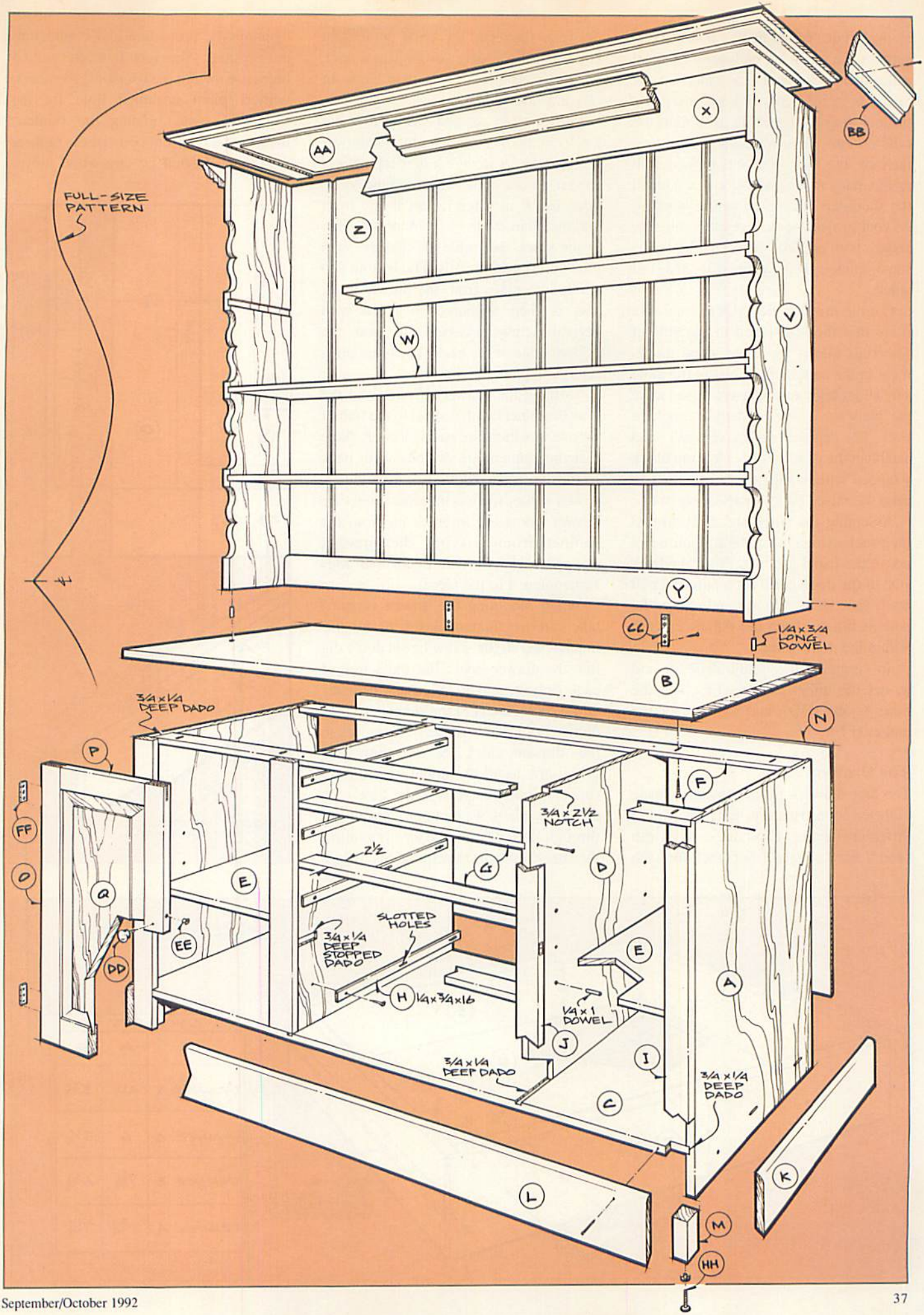
Part	Description	Size	No. Req'd.
	Base Section		
A	Side	3/4 x 17 x 32 1/4	2
B	Top	3/4 x 18 3/4 x 70	1
C	Bottom	3/4 x 17 1/2 x 67	1
D	Divider	3/4 x 16 3/4 x 28 1/2	2
E	Shelf	3/4 x 16 5/8 x 18 1/8*	as req'd
F	Stretcher	3/4 x 2 1/2 x 67	2
G	Drawer Frame	3/4 x 2 1/2 x 29	3
H	Drawer Runner	1/4 x 3/4 x 16	8
I	Side Stile	3/4 x 2 1/2 x 32 1/4	2
J	Center Stile	3/4 x 2 1/2 x 28 1/4	2
K	Base Side Mold'g	3/4 x 4 x 18 1/2	2
L	Base Front Mold'g	3/4 x 4 x 69 1/2	1
M	Foot Block	1 1/2 x 1 1/2 x 3 1/4	4
N	Back	1/4 x 29 x 67 1/2	1
	Doors		
O	Stile	3/4 x 2 7/8 x 28 1/4	4
P	Rail	3/4 x 2 7/8 x 14 3/4	4
Q	Panel	3/4 x 10 1/4 x 23 7/8*	2
	Drawers		
	(see chart for part widths; No. Req'd is per drawer)		
R	Front	3/4 x (see chart) x 28 1/2	1
S	Back	3/4 x (see chart) x 27 1/2	1
T	Side	3/4 x (see chart) x 16	2
U	Bottom	1/4 x 15 3/4 x 27 1/2	1
	Upper Section		
V	Side	3/4 x 7 1/4 x 47 3/4	2
W	Shelf	3/4 x 6 1/2 x 67	3
X	Front Stretcher	3/4 x 5 x 66 1/2	1
Y	Back Stretcher	3/4 x 3 3/8 x 66 1/2	1
Z	Back	See Back Detail	as req'd
AA	Top	3/4 x 9 7/8 x 73 1/4	1
BB	Molding	2 5/8 crown	about 8 ft.
	Hardware		
CC	Bracket**	5/8 x 4	2
DD	Knob**	1 dia.	2
EE	Bullet Catch**	3/8 dia.	2
FF	Hinge**	2 long x 1 3/8 wide	4
GG	Brass Pull**	3 in. post centers	8
HH	Leveler**	As shown	4

* Shelf dimensions are sized smaller than available space to allow for easy repositioning. Panel width and height allow 1/4 in. and 1/8 in., respectively, for wood movement.

** These parts available as a kit (see Kit Source).

Kit Source

Hardware parts kit (including brackets, solid brass knobs, bullet catches, solid brass hinges, solid brass pulls, and levelers) is available from Aspen Kits, 6 Hilltop Drive, Old Saybrook, CT 06475; tel. (203) 388-6179. Specify Hutch Hardware Kit; Cost is $112 postpaid; checks or money orders only.


FULL-SIZE PATTERN
AA
X
BB
Z
W
V
Y
CC
1/4 x 3/4 LONG DOWEL
B
3/4 x 1/4 DEEP DADO
N
P
F
FF
3/4 x 2 1/2 NOTCH
2 1/2
G
D
O
Q
E
SLOTTED HOLES
3/4 x 1/4 DEEP STOPPED DADO
EE
DD
H 1/4 x 3/4 x 16
1/4 x 1 DOWEL
J
I
A
3/4 x 1/4 DEEP DADO
3/4 x 1/4 DEEP DADO
C
K
L
M
HH

in. wide cut. You'll need a tenon jig to support the stock on end as you pass it across the dado head. The tenon on the rail ends is best cut with a regular saw blade. Using the tenon jig to support the rails on end, first make the cheek cuts, then use the miter gauge equipped with an auxiliary fence and a stop to establish the shoulders. However, before working on your project stock, test your table saw setups with a piece of scrap that's the same thickness as your stile and rail stock.

Cut the raised panels (Q) to final size (note that the size listed in the Bill of Materials allows for some wood movement in the panel). Then, using the table saw and a high auxiliary rip fence, raise the blade to a 2 1/2 in. height, angle it over 12 degrees from vertical, and establish the panel profile. A scrap block wrapped with sandpaper can be used to sand the raised panel shoulder square.

Assemble the stiles and rails around the panel, using glue at the slip joints but not in the panel grooves. From the back side of the doors, drill for a pair of small brads (one in the top rail and one in the bottom rail) to keep the panel centered within the door frame.

To complete the doors, drill for and mount the bullet catches (EE), add the brass knobs (DD), and mortise for the hinges (FF).

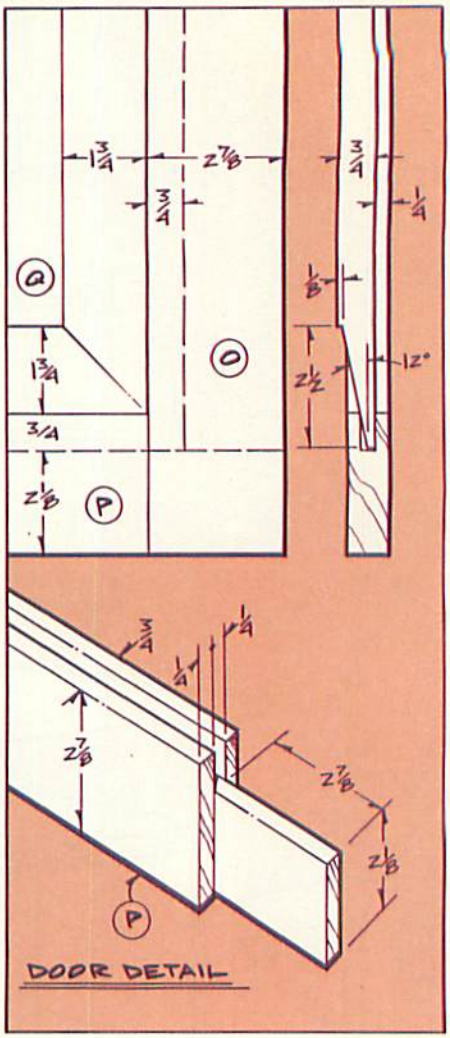
The Drawers

The four drawers all use the same basic rabbeted construction, but each is a different height. Rip stock to width (you'll need about 8 ft. of stock for each drawer), then cut the parts to length. Note that the drawer design uses a back (S) that's 1/2 in. narrower than the front (R) and sides (T).

Use the table saw and dado head to cut the 1/4 in. by 1/4 in. groove for the drawer bottom, the 3/4 in. by 1/4 in. deep drawer runner groove in the sides, and the 3/4 in. wide by 1/2 in. deep rabbet in the front and the 3/4 in. wide by 1/4 in. deep rabbet in the sides. Assemble the drawers with glue and finishing nails. The bottom (U) slides into place from the drawer back, and is then anchored in place with several screws inserted up into the bottom edge of the back. The brass pulls (GG) complete the drawers.

To hang the drawers, first locate the drawer runners with respect to the runner groove position in each drawer. Note that the runners are placed 1/4 in. back from the front edge of the dividers, which serves to stop the drawers so the drawer fronts are inset 3/4 in. from the cabinet front. Having the drawers stepped back is a nice detail that adds some interest to the piece.

When mounting the drawer runners, take care to countersink for the mounting screws, so the screw heads don't dig into the drawer sides. Test the action of each drawer, and if necessary trim the width or thickness of the runners so they don't bind in their respective grooves in the drawer sides. Screws only—no glue—are used to mount the drawer runners. Remember, as is the case with any parts where we mount to other parts through slotted holes, the idea is to allow the crossgrain part to respond to changes in humidity, expanding and contracting unrestricted. The fact that the slotted holes are toward the back of the runners, with a plain unslotted hole for the frontmost screw holding the runners, insures that the front point of the runners won't be affected by any wood move-



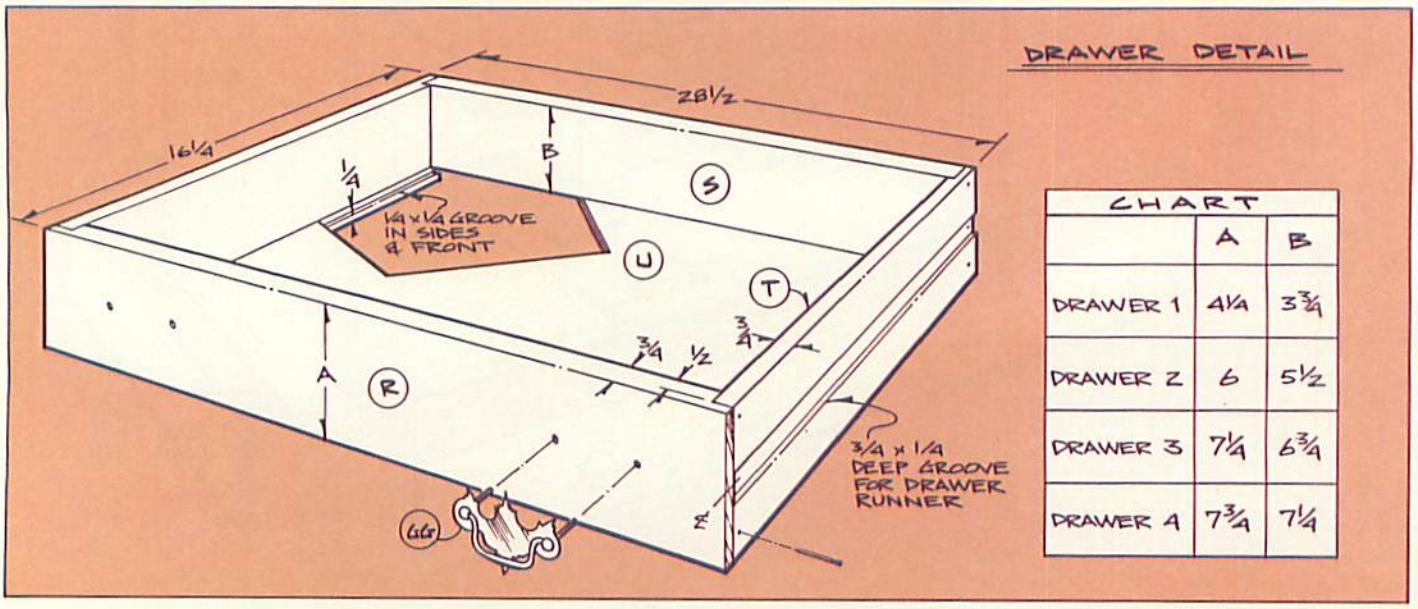
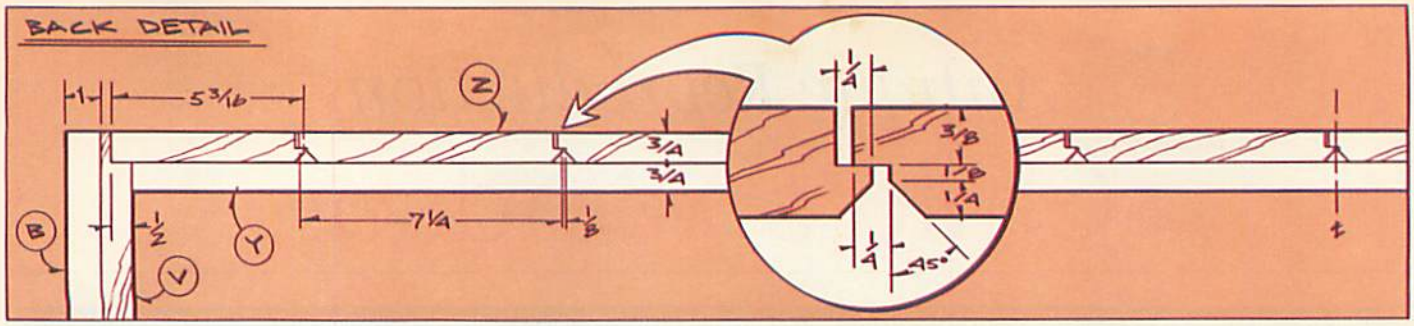
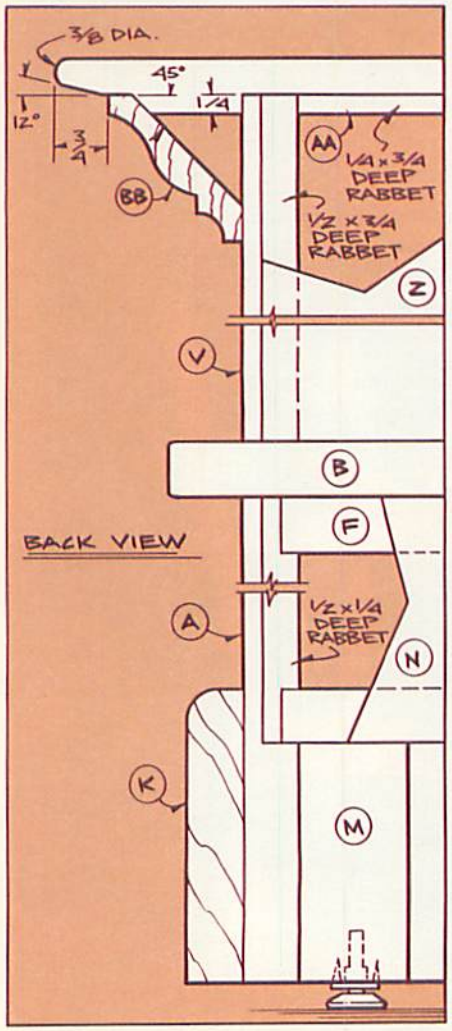


CHART	A	B
DRAWER 1	4 1/4	3 3/4
DRAWER 2	6	5 1/2
DRAWER 3	7 1/4	6 3/4
DRAWER 4	7 3/4	7 1/4





ment. This in turn means that no matter how much wood movement occurs in the base, the drawer fronts will always be inset the same 3/4 in. from the cabinet face.

The Upper Section

The upper section sides (V) and shelves (W) are cut from 1 by 8 pine boards, measuring 7 1/4 in. wide. The boards are used full-width for the sides, and are ripped down to 6 1/2 in. for the shelves.

Once the sides have been cut to final length, lay out the shelf dado locations, cut the 1/2 in. wide by 3/4 in. deep rabbet for the back boards and transfer the full-size whale-tail scroll pattern to the stock. The easiest way to transfer the pattern is to first make a template from the full-size pattern shown on page 37, and then use that template to trace the actual pattern onto the board.

To make your template, first take a plain sheet of typing paper, and fold it in half across the middle. Slip the folded sheet of paper under the full-size pattern on the page, so the folded edge is lined up with the pattern centerline, slip a piece of carbon paper between the folded paper and the pattern page, then trace the profile. Use a sharp scissors to cut the profile out, then unfold the paper. You now have a complete full-size pattern template. Use this template to transfer the repeating whale-tail scroll pattern to one of the sides, then cut the dadoes in both sides for the shelves. The scroll cutouts can be made with a scroll saw, or a hand-held jigsaw. After making the cutouts in one side, sand to remove any saw marks, then use that side as a template to trace the profile to the remaining side. Cut the profile on the last side, then glue, assemble and finish nail the sides and shelves together.

Next, cut the front and back stretchers (X, Y) and use glue and finishing nails to secure these parts to the side/shelf assembly. The back (Z) is a series of shiplapped 3/4 in. thick boards. You can purchase 1 by 8 pine boards, and cut the rabbets and chamfers yourself, or just buy shiplap siding, where all that you'll need to do is cut the boards to length. Note that the two side pieces of the back must be ripped down to fit. Use countersunk screws to mount the back boards, taking care to adjust the boards so as to allow a 1/8 in. space between each one, as shown in the Back Detail. Use only a single screw, centered in the board width, at each attachment point, so the boards are free to respond to changes in humidity.

As the exploded view shows, the top (AA), is basically just a 3/4 in. board, with a groove to fit the sides and front stretcher and rabbets to fit the back and crown molding (BB). The most accurate way to lay out the grooves and back rabbet is to position the top over the side/shelf/stretcher/back assembly, and then use a pencil to trace the groove and back rabbet location. Use the router equipped with a straight cutter and an edge guide to cut the grooves and the rabbet for the back. Take care not to remove too much stock at once. You can always test-fit the top and take off a little more if the fit doesn't quite make it.

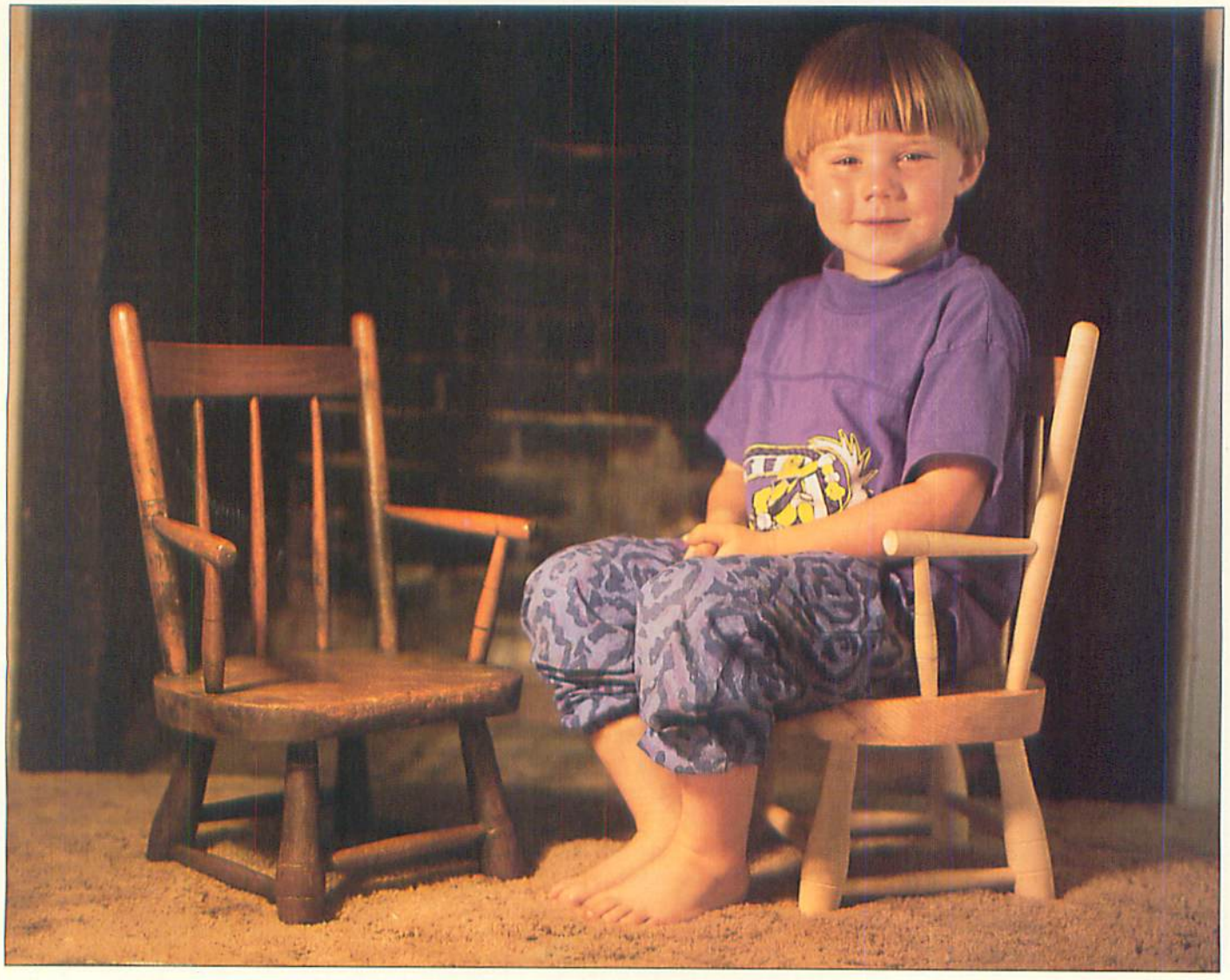
To cut the rabbet for the crown molding, temporarily locate the top in place, then hold the crown molding in position to get the proper location of the rabbet. The 45 degree angled side of the rabbet (see Back View) can be established with the table saw, with the blade tilted over to 45 degrees. Gauge the stock off the rip fence for the rabbet on the front, and use the miter gauge to make the rabbets on the sides. Then clear out the remaining material in the rabbet using the router, a straight bit and the edge guide. Finally, use the table saw to cut the 12 degree angle on the bottom edge of the lip (see Back View), then use the router table and a 3/8 in. diameter bullnose bit to establish the 3/8 in. bullnose on the edge. Glue and finish nail the top in place, then add the crown molding to complete the top section.

Finishing Up

The base and top sections should be finished separately. You could use a light stain followed up with a shellac or lacquer, but polyurethane is perhaps a little better choice, given its durability. When the finish is dry, mount the top section to the base with a pair of straight brackets (CC). As shown in the exploded view, a pair of dowel pins—one for each side, helps index the top section relative to the base.

Antique Reproduction

Child's Windsor



Although certainly not reminiscent of the sweeping lines and delicate turnings that we generally associate with classic Windsor chairs, this Colonial era Child's Windsor nonetheless shares a common pedigree with its more refined relatives. It's representative of the great variety of Windsor-derived designs that were made by country carpenters and cabinetmakers, from the Colonial period well into the 1800's. During the winter months, when there wasn't much to be done outdoors, most anyone with even modest joinery skills would set to work building furniture, which for the common folk, was always in short supply.

Indeed, for the family that owned this charming little piece, the chair was no doubt something of a luxury. More often than not, children sat on stools or benches. Even a good quality full-size chair, if one were available, was usually reserved for the master of the house. That our little chair was well-used by what was probably a succession of children is plain to see by the wear. But curiously, the parts of the chair that are most worn are the tops of the back posts and the bottoms of the back legs. A substantial flat area has been worn into the back edges of these parts.

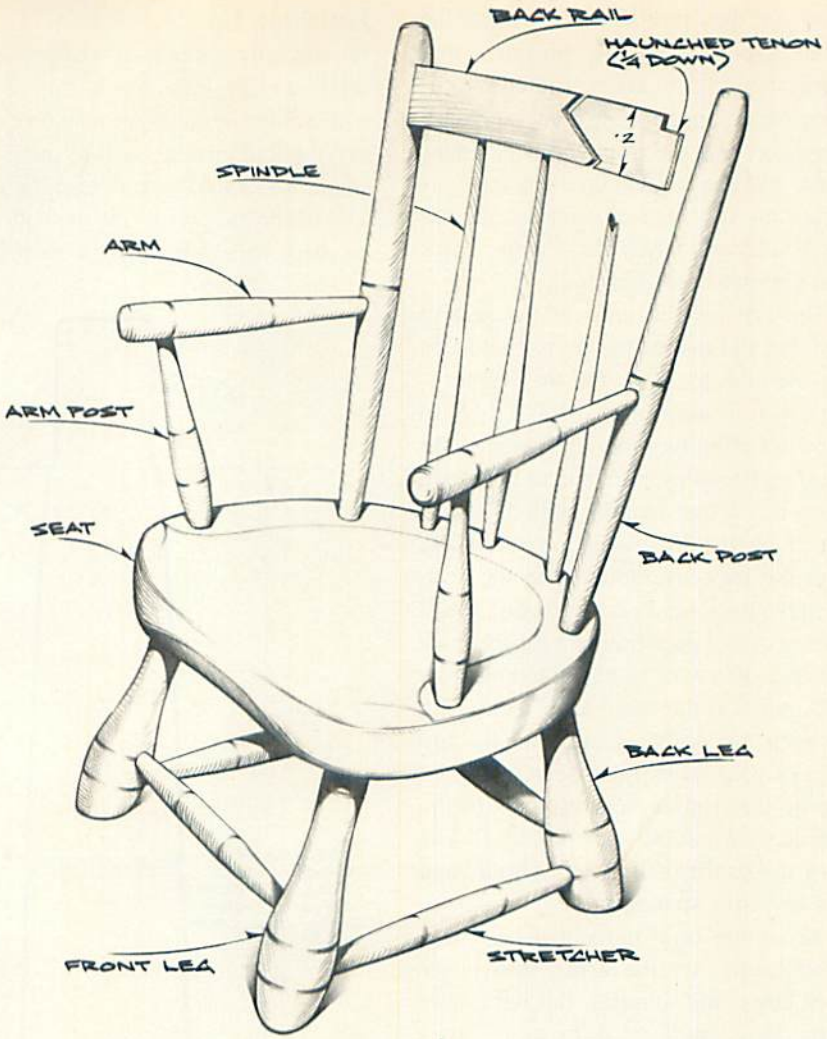
The chair's owners, George and Mildred Gerath, of Collinsville, Connecticut, explained these telltale flats are witness to the fact that this child's Windsor served as a walker to toddlers just learning to get around. With the chair laying on its back (see photo on page 43), the youngsters would grasp the seat or front stretcher, and push the chair across the floor. In the absence of the plastic walkers that we're all too familiar with today, it's not hard to understand that children from earlier times also

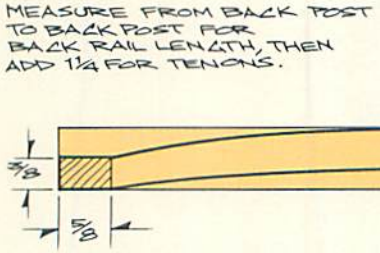
needed a little something to hang onto as they managed their first few steps.

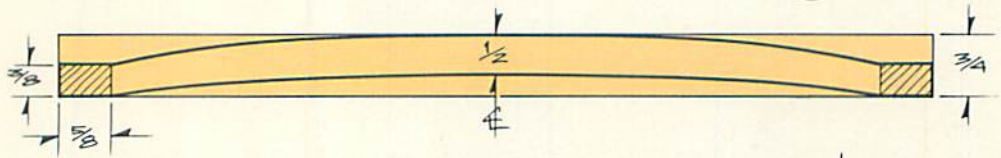
Getting Out Stock

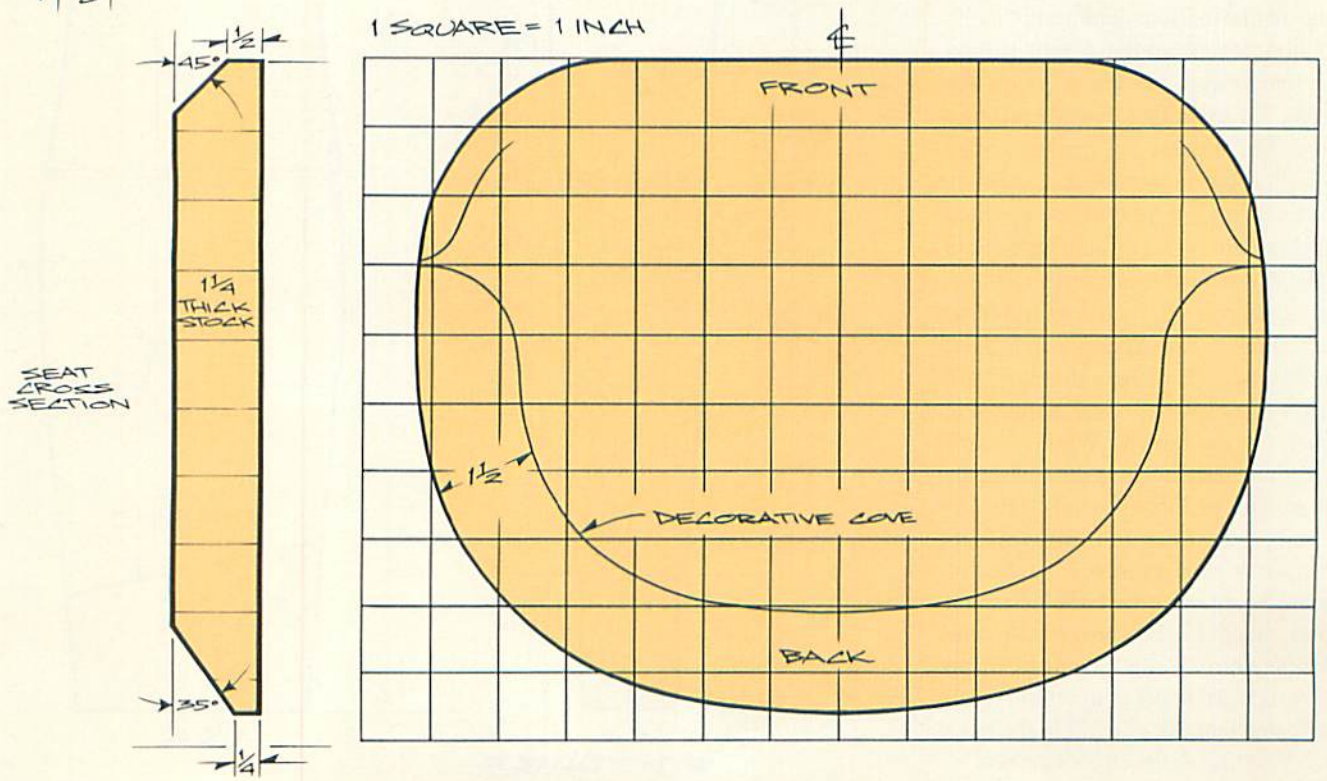
As Roger Holmes notes in his feature on chairbuilding (page 16), a variety of woods can be used, including green wood—perhaps from your own backyard—for the turnings. The seat can be cut from a pine board, or from a hardwood if you prefer. The back rail can be just about any hardwood—on our antique it was chestnut.

We've provided full-size patterns for the turnings and a grid pattern for the seat. The decorative cove detail on the seat is shown on the seat pattern. Although not readily apparent from the









photo, on the original, this cove and the detail grooves on the turnings that correspond to the various stretcher locations were painted with a yellow paint. Also, note that the front and back edges of the seat are beveled on the bottom, as shown in the seat cross-section. This slight undercut gives the 1 1/4 in. thick seat a somewhat lighter look.

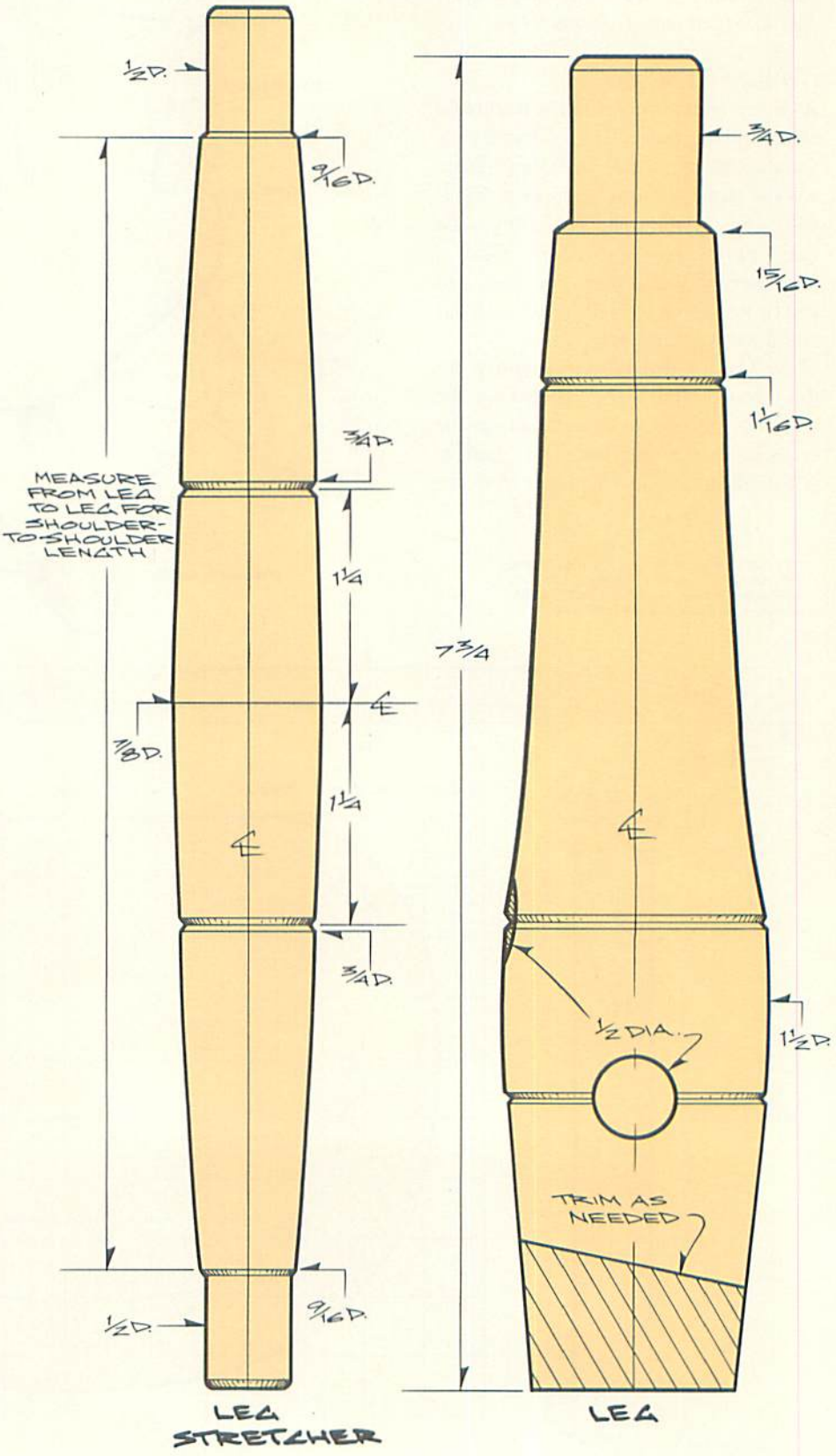
You can lay out and cut the seat to size, but the rest of the parts should be cut oversize for now. On the leg turnings, you'll want that extra length to allow for trimming the leg bottoms. On the stretchers, this extra length is needed since the actual lengths will be determined by the leg-to-leg measurements after the legs are mounted to the seat. Even the back rail is cut oversize. You'll take an actual measurement for the back rail only after you've test-assembled the back posts to the seat. After measuring between the posts, scribe onto the top edge of your 3/4 in. thick source board a profile that roughly corresponds to the profile shown in the back rail detail. The back rail profile can be cut with a band saw or with a spokeshave.

About the only parts that can be a fixed length are the arms, arm posts, back posts, and spindles. But with these parts too, you'll need to allow extra length for mounting the parts in the lathe. As you'll note from their respective full-size patterns, on the arm posts and back posts, we show lengths from the end to the bottom tenon shoulders. The bottom tenons on these parts should be cut longer than needed, to allow for trimming the extra that extends through the seat. These parts are trimmed after the chair has been assembled.

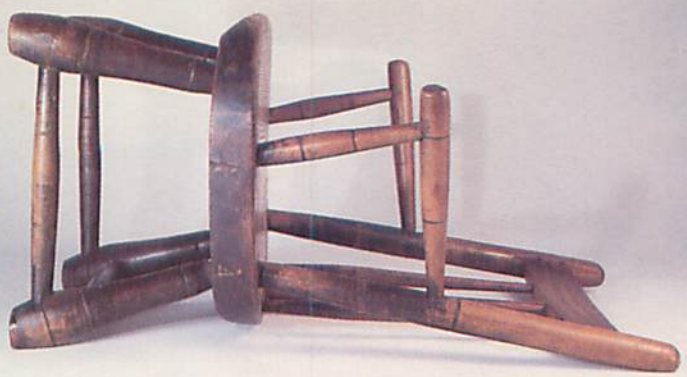
Once you've got your stock roughed into blanks for the various parts, and with the seat shaped to the profile shown in the grid pattern, you can refer to Roger Holmes' chairmaking article for a photo step-by-step of how the parts are turned, the socket holes are bored, and the chair is assembled. While it isn't critical that your turnings match perfectly to our profiles, it may help to make templates from the full-size patterns to serve as a reference. Several of our turning patterns (the back posts and spindles) had to be broken on the full-size pattern to allow them to fit on the page, but just make your templates to the indicated lengths, and fair in the lines on your patterns to the shapes shown.

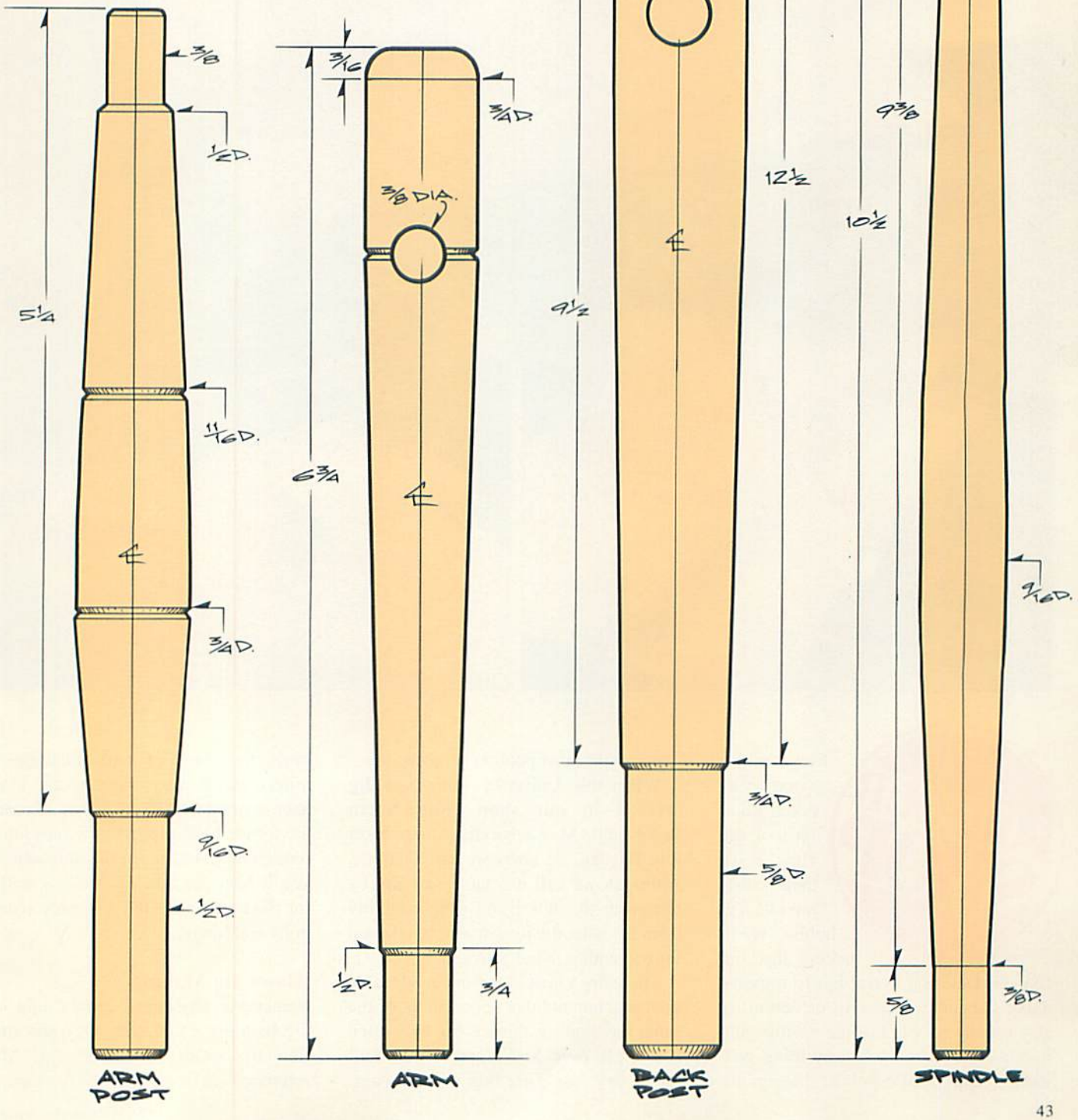
Finishing Up

We can only guess as to the finish on the original chair, but a black stain or paint, with yellow ochre highlights on the seat carving and turnings will be quite handsome. You could even sand a flat on the tops of the back posts and the bottoms of the back legs to imitate the wear on the original. Remember, your chair may not end up looking exactly like ours, but that won't mean that it's less comfortable or attractive. The little antique chair shown has brought a good deal of pleasure to many youngsters over the years, and your chair should have no problem filling the same need.



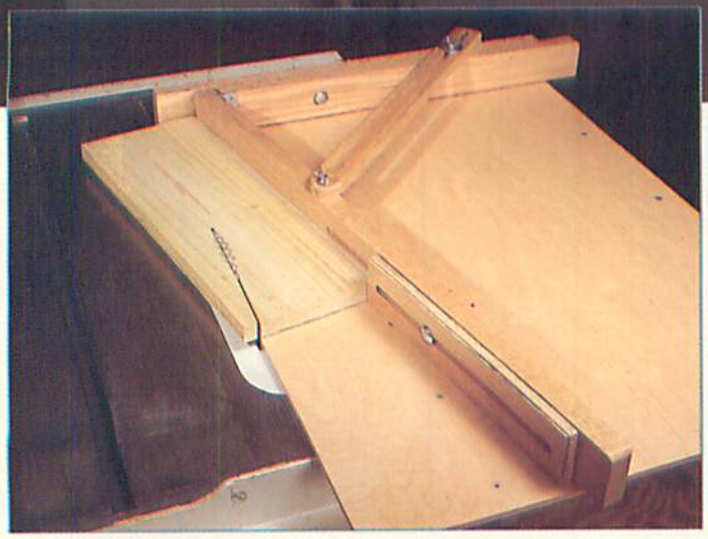
Chair is shown on its back, as used by toddlers just learning to walk.

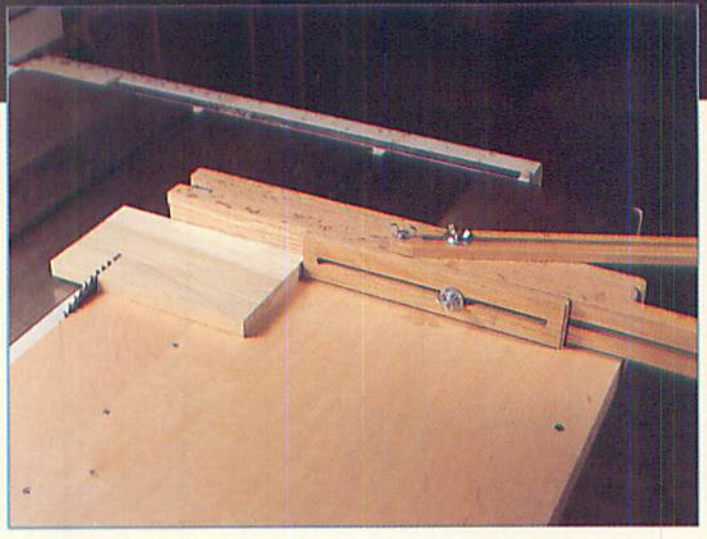




Universal Table Saw Jig

Triple duty jig handles cutoffs, miters and tapers





FOR YOUR SHOP

For many woodworkers, a good part of the fun with their woodworking hobby is in making jigs and fixtures. Devising useful jigs to improve a tool's accuracy, capacity, or versatility also usually results in time savings and improved accuracy when building projects, so there's little wonder that jigs are among our most popular projects.

When this Universal Table Saw Jig arrived in our shop from North Brookfield, Massachusetts woodworker Ray Hayden, we knew we had a winner. Although we call it a table saw jig, by removing the fence and arm assembly from the base, the jig can also be adapted for use with a radial-arm saw.

There are a host of factory-made table saw attachments that serve many of the same functions as this jig, but they often cost well over $100, and we haven't found any single jig that so well combines the three primary functions of miters, cutoff work and tapering. If you have a suitable piece of plywood available for the base, plus a few scraps for the remaining parts, about the only expense you'll have for this jig is a few dollars for the hardware—the assembly screws, bolts and hinge.

About Jig Making

Remember, anytime you make a jig, you are building a tool. Accuracy and attention to details are important. Mark reference surfaces, and always measure

twice. Resist the temptation to sand excessively, as this tends to produce unevenness.

Materials selection is also important with jig making. Although you could use hardboard or birch plywood for the base, we used Appleply. Appleply is the domestic equivalent of Baltic birch plywood, but costs a bit less than the imported version. Its name notwithstanding, Appleply is not made from apple wood. Instead, it's a multilayered sandwich (five layers for the 1/4 in. thickness that we used) of aspen, a wood that's very similar in strength and characteristics to Baltic birch. The beauty of Appleply (and Baltic birch) is that it has exceptional strength and stability when compared with construction grade plywoods of the same thickness. Although Appleply is relatively new, it is now carried by many building supply centers. If your local yard doesn't stock it, you can usually ask that it be special ordered (contact the manufacturer, States Industries, at (503) 688-7871).

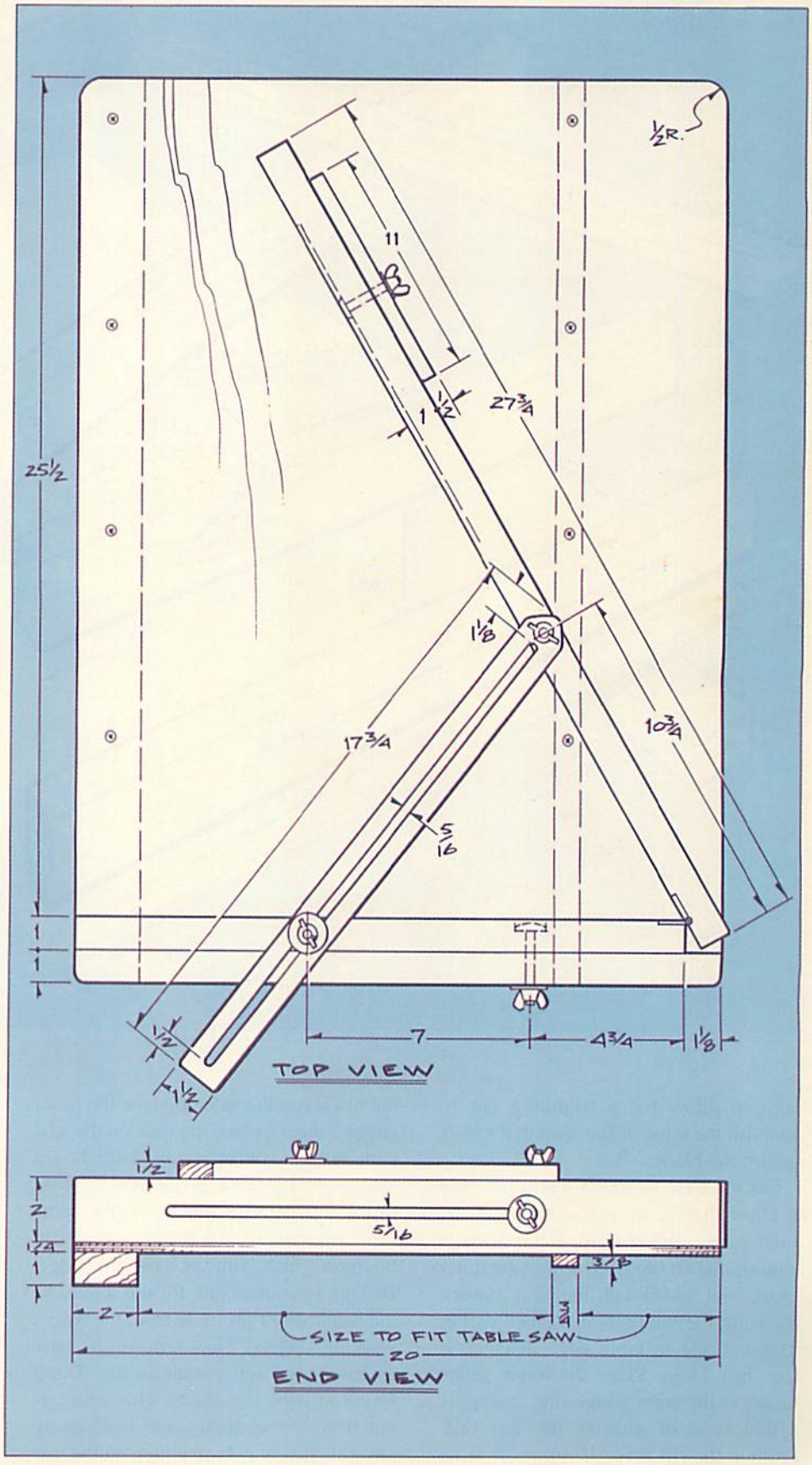
The remaining wood parts on our jig are made of oak, but maple would also be a good choice. The important points here are that the stock you use be thoroughly kiln-dried, straight-grained and true; you don't want jig parts warping or twisting.

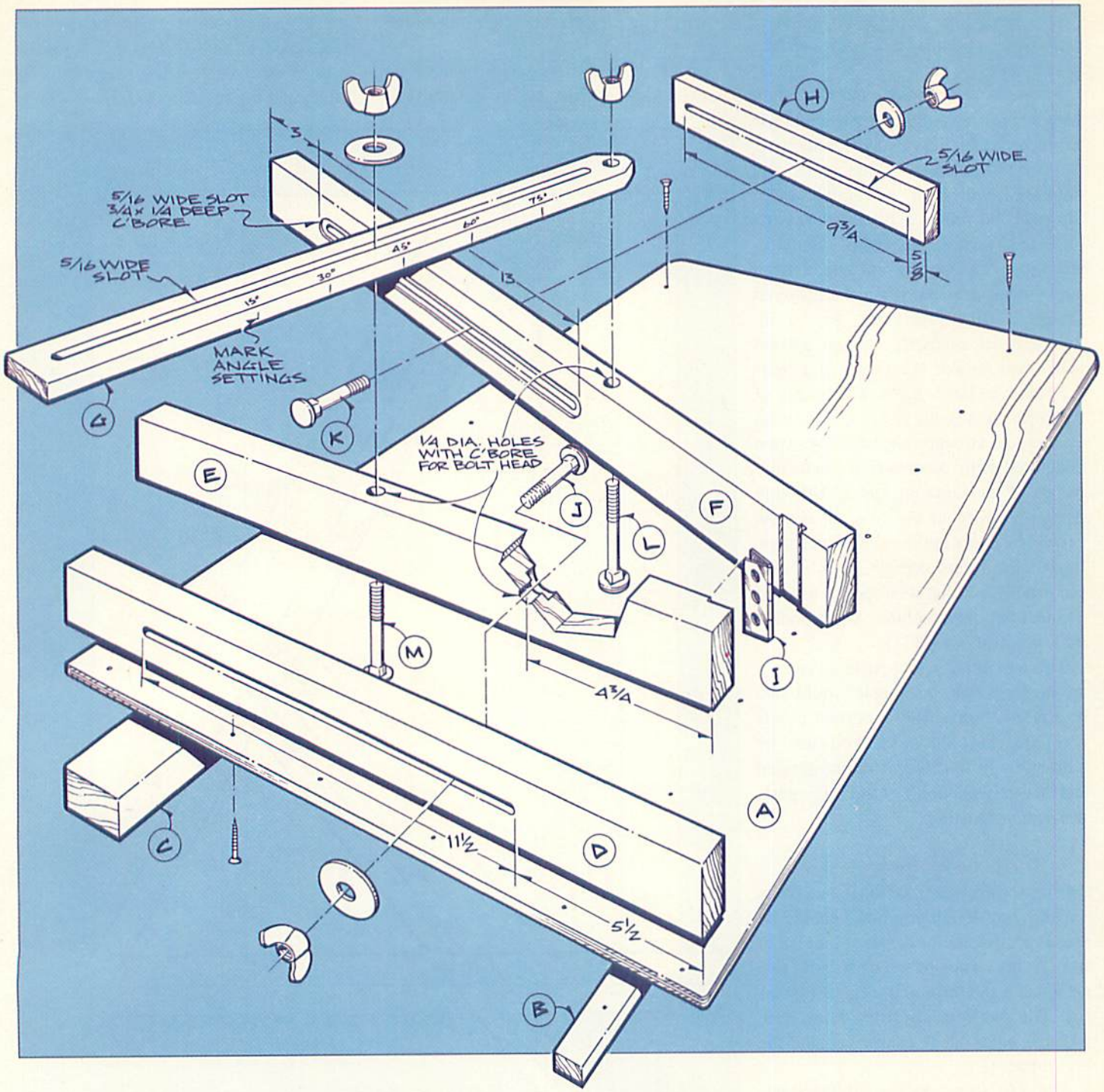
Construct the Platform

The jig shown was sized to fit on a Delta Unisaw, but the jig you make should be sized specifically for the saw you plan to use it on. The jig consists of two sections, a platform and a fence assembly. The platform consists of the base (A), the miter gauge runner (B) and the end runner (C).

Size The Base: As the photos show, one edge of the jig base kisses against the saw blade; the overall width of the base, and therefore the length of the fence parts, will depend on the size of your saw table. However, the base should have a width of at least 20 in., to accommodate the slot length and adjustability that we show. If your saw measures less than 18 in. from the blade to the saw table edge, make the jig base 20 in. wide, and just increase the width of the end runner as needed. Although we show the jig used on the left side of the blade, you can also construct and size the jig for use on the right side of the saw table.

The rough starting width of the base needs to be at least 2 1/2 in. greater than the distance from the blade to the saw table edge. Of that 2 1/2 in., 2 in. is for the area of the base that overhangs the saw table, and the remaining 1/2 in. is a little





extra to allow for a trimming cut to establish the edge of the base that kisses against the blade.

Cut the base to rough width (be sure to allow that 1/2 in. extra), then cut the miter gauge runner strip, sizing it for a snug sliding fit (no slop) within the miter gauge slot. Also cut the end runner, adjusting the width as described earlier if your blade to table edge distance is less than 18 in. Place the miter gauge runner in the miter gauge slot, and apply a thin bead of glue to the top side. Position the rip fence 1/2 in. away from the blade (on the side opposite the miter gauge runner), place the base on the saw table with the oversize edge butted tight against the rip fence, then screw the base to the miter gauge runner. At the same time, glue and screw the end runner to the base, flush with the saw table edge. Be sure to countersink for the screws so the heads don't protrude from the base's working surface. Now remove the base assembly and set it aside to dry. Don't forget to wipe any excess glue squeeze-out from the assembly, and to clean up any glue that may have gotten on the saw table or in the miter gauge slot.

Once dry, place the base assembly on the saw table and cut off the 1/2 in. extra from the base, establishing the edge that kisses the saw blade. Also, slightly round the corners of the platform, as shown.

Make the Fence Assembly

The fence assembly consists of a fixed fence (D), a sliding fence (E) a pivoting fence (F), a locking arm (G) and an adjustable stop (H). The three fence parts are all made from 1 in. thick by 2

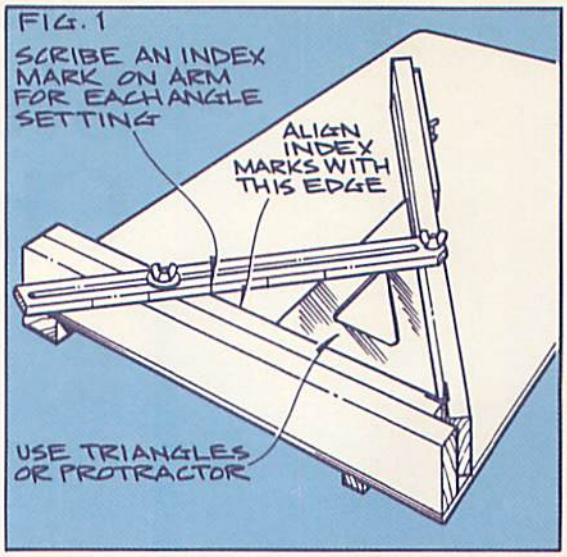
in. wide stock. The arm and stop are made from 1/2 in. thick stock.

The lengths of the fixed and sliding fence parts will be determined by the width of the platform. However, they shouldn't be any shorter than the 20 in. and 18 7/8 in. lengths, respectively. Whatever the platform width, make certain that the sliding fence is 1 1/8 in. shorter than the fixed fence.

Once the fence, arm and stop parts have been cut to length and width, establish the various holes and slots. The slots are all cut on the router table using a straight bit that's equal to the slot diameter, with stopblocks clamped to the router table fence to index where the slots will start and stop. Don't try to make the slots in a single pass. Instead, make the slot in a series of passes, raising the bit about 1/8 in. for each subsequent cut until the slot is complete.

As shown in the exploded view, the 5/16 in. wide by 11 1/2 in. long slot in the fixed fence starts 5 1/2 in. from the end of the fence that's flush with the base edge that kisses the saw blade. Also cut the slots in the pivoting fence, locking arm and adjustable stop. Note that there's a second slot, 3/4 in. wide by 1/4 in. deep, cut into the inside face of the pivoting fence. This oversize slot, which is cut with a 3/4 in. diameter router bit, serves as a counterbore so the head of the bolt that holds the stop in place doesn't protrude, a situation that would be a problem when the jig is used as a cutoff table. When drilling the various bolt holes, note that the two holes through the sliding fence and the single hole through the pivoting fence are also counterbored.

Mortise the sliding and pivoting fence parts for the hinge (I), then make small rabbet cuts into the fence parts and stop, as a relief area to prevent sawdust buildup between the fence parts and platform, and on the inside corner where the pivoting fence and stop meet. Finally, you may want to add a sandpaper surface to the working face of the pivoting fence. The sandpaper (which should be glued in place with a spray-type adhesive that would allow for easy



paper replacement) serves to provide some extra support to keep stock from creeping when the jig is being used for tapering or mitering.

Fence Assembly

Locate and mount the fixed fence to the platform. Don't assume that the back edge of the base is automatically square to the blade edge. Instead, use a large square (such as a framing square) to set the fixed fence at an exact right angle to the base edge that kisses the blade. Then use glue and countersunk screws to permanently fasten the fixed fence to the base.

Join the sliding and pivoting fence parts with the hinge, insert the 2 1/2 in. long carriage bolts (L, M) and mount the locking arm, then mount the stop to the pivoting arm, and the sliding fence to the fixed fence, using the remaining carriage bolts (J, K).

Bill of Materials
(all dimensions actual)

Part	Description	Size	No. Req'd.
	Platform		
A	Base	1/4 x 20 x 27 1/2*	1
B	Miter Gauge Runner	3/8 x 3/4 x 27 1/2*	1
C	End Runner	1 x 2 x 27 1/2*	1
	Fence Assembly		
D	Fixed Fence	1 x 2 x 20*	1
E	Sliding Fence	1 x 2 x 18 7/8*	1
F	Pivoting Fence	1 x 2 x 27 3/4	1
G	Locking Arm	1/2 x 1 1/2 x 17 3/4	1
H	Adjustable Stop	1/2 x 2 x 11	1
	Hardware		
I	Hinge	1 1/2 x 2 long	1
J	Bolt, Washer, Wing Nut	5/16-20 x 2 1/2 long	1 each
K	Bolt, Washer, Wing Nut	5/16-20 x 1 3/4 long	1 each
L	Bolt/Wing Nut	1/4-20 x 2 1/2 long	1 each
M	Bolt, Washer, Wing Nut	1/4-20 x 2 1/2 long	1 each

* Width of base, and length of fixed and sliding fence parts will depend on the size of your saw table, but should not be less than the sizes indicated. If the distance on your saw table from the blade to the left edge of the table measures less than 18 in., then increase the width of the end runner to a dimension that, when added to the distance from the blade to the table edge, will total 20 in. Thickness and width of miter gauge runner is sized to fit your miter gauge slot.

Setting the Scale

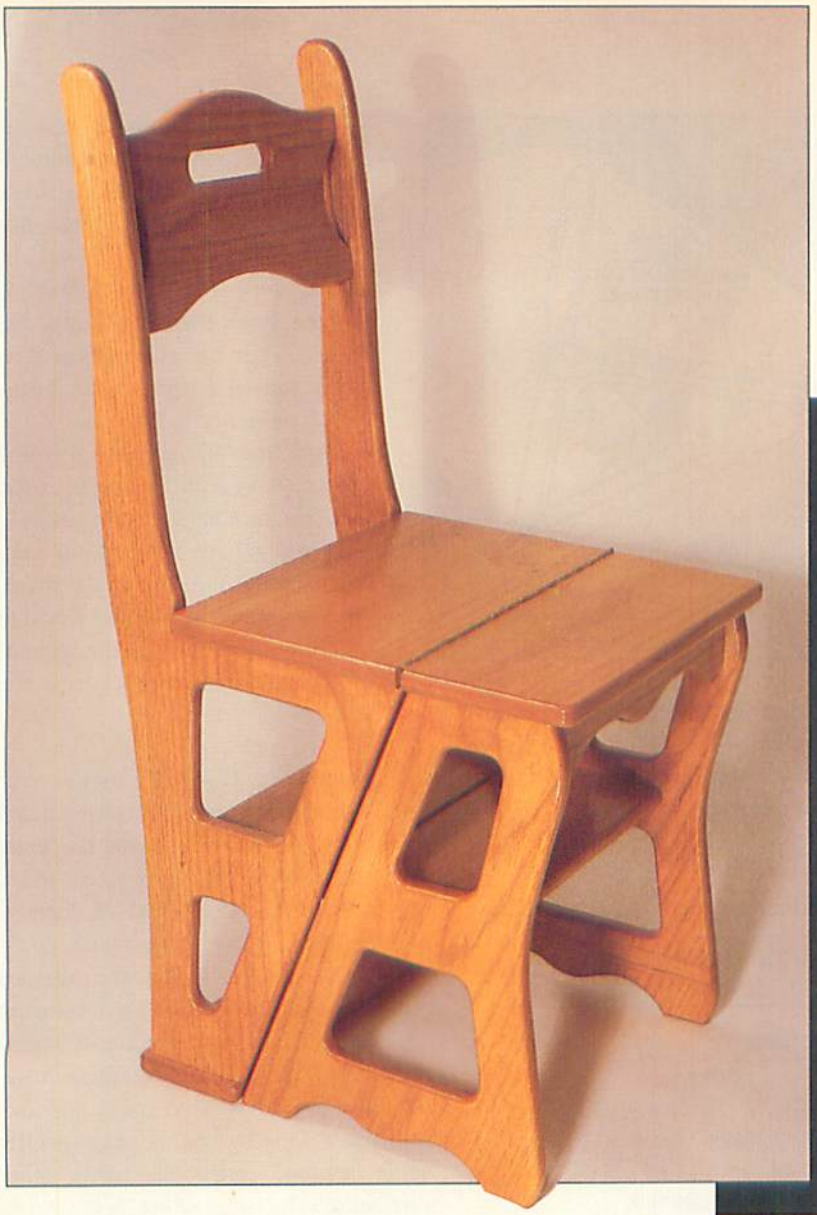
As shown in Fig. 1, you'll want to scribe a scale on the locking arm, making index marks for, at the very least, the most common angles. We've scribed index marks at 15, 30, 45, 60 and 75 degrees, but you can add more if you wish.

Here's how to locate the various points on the locking arm. First, using an adjustable triangle, a machinist's protractor, or fixed triangles, set the adjustable fence to each desired angle, *and lock* it in place. One by one, at each specific angle setting, scribe an index mark vertically on the edge of the locking arm, so it aligns with the top edge of the sliding fence. Use a combination square as a guide to scribing these index marks, to insure that they are straight. You can write in the angle at each scribe mark on the locking arm, or use a set of number punches, as we have, to stamp the numbers into the wood. Given the length of the locking arm, if you are reasonably accurate in making the index marks, this jig will yield superior accuracy compared to using your table saw's miter gauge angle settings.

Finishing Up

As mentioned earlier, don't sand surfaces. However, the back edge of the fixed fence should be gently rounded, since this is where your hands grasp the jig. No finish is needed, though you may want to rub in a little penetrating oil to give the piece a finished appearance.

Convertible Step Stool/ Chair



Every day of the week, project requests from readers arrive here at *The Woodworker's Journal* offices. Some are in letters, other are scribbled on the backs of subscription renewals, and often the request is accompanied by a sketch. Over the years, one of the most requested projects has been the step stool/chair. Readers have referred to it as a library chair, a convertible chair, a folding step chair, and a host of other things, but whatever they called it, the function was the same: a chair that quickly converted into a little step ladder.

Although we have previously published plans for a similar step stool/chair (we called it a 19th Century Step Chair; plans are in our book *Projects for Woodworkers, Volume 2*), that chair was an antique, and didn't have a look that fitted in easily with most home decors. So our eyes have always been open, looking for a good new step stool/chair plan to publish. When a snapshot of this version arrived in our mailbox, sent by Texas woodworker A.B. Beavers, we knew we had a winner. After studying similar pieces, A.B., who is a retired machinist, worked up these plans himself. And since, as he says "I've always wanted my wife to see New England and eat fresh lobster," A. B. and wife Darline decided to drive up and hand-deliver the step stool/chair here to our Connecticut offices, while at the same time taking in the sights—and tastes—of a mini New England vacation.

We think A.B.'s design is simplicity itself. As illustrated in the cutting diagram, all the parts can be obtained from a single 1 by 12 board, measuring $^{3}/_{4}$ in. thick by $11^{1}/_{4}$ in. wide by 12 ft. long. As pictured, the chair is crafted in oak, but almost any good hardwood, such as cherry, maple or walnut, can be used. The attractive use of gentle curves, clean lines and rounded edges makes this chair fit in with almost any decor, whether it's

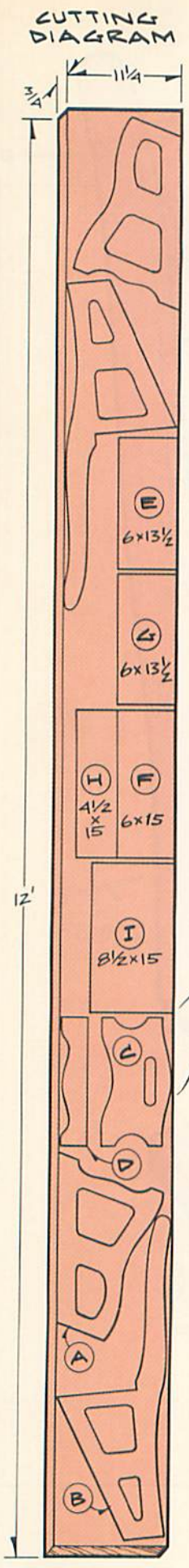
used in the kitchen to reach those high shelves in the upper cabinets, in the bedroom to get to the closet shelf, or elsewhere.

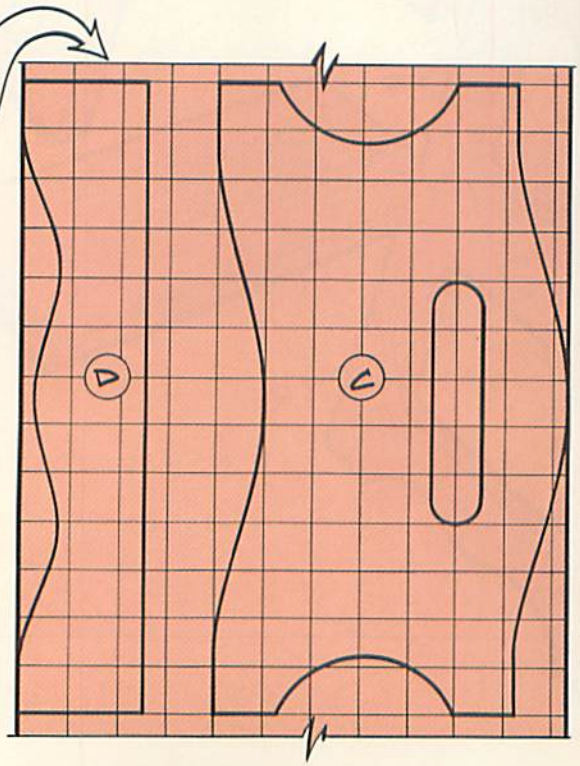
The design that allows these projects to convert from a step stool to a chair, and back again, is both clever and simple, but it's somewhat hard to visualize if you don't have the chair in front of you. Basically, the chair is designed so that there are two sections, linked by a piano hinge. To convert from the step stool to the chair mode, the top section of the stool is pivoted over the lower section, so that the top step of the stool is now resting on the floor. Hopefully, our time-lapse illustration on page 51 will help with visualizing the conversion.

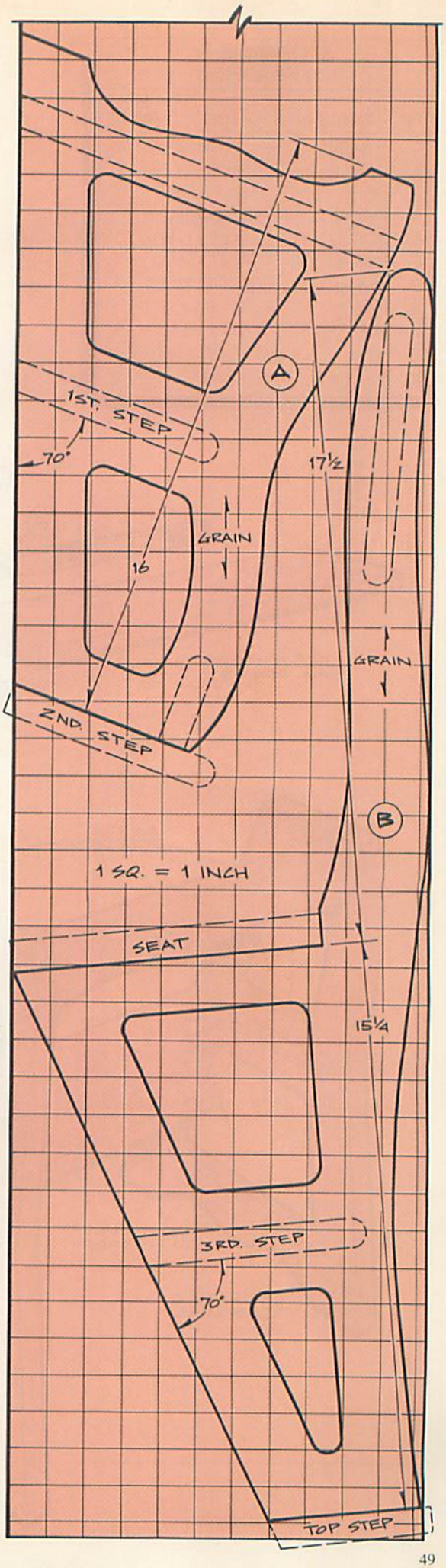
Getting Started

Thankfully, building the step stool/chair is considerably easier than trying to imagine how it works. The most important parts—the lower and upper sides (A, B)—are provided as a grid pattern exactly as they are to be laid out on your 1 by 12 board. As the Cutting Diagram shows, one of each of the sides is laid out on each end of the 1 by 12 board. The way to make these four parts is to first lay out one each of the side sections on the bottom end of the board, exactly as they appear in the grid pattern.

Transferring the Patterns: There are several ways to accomplish this. First, if

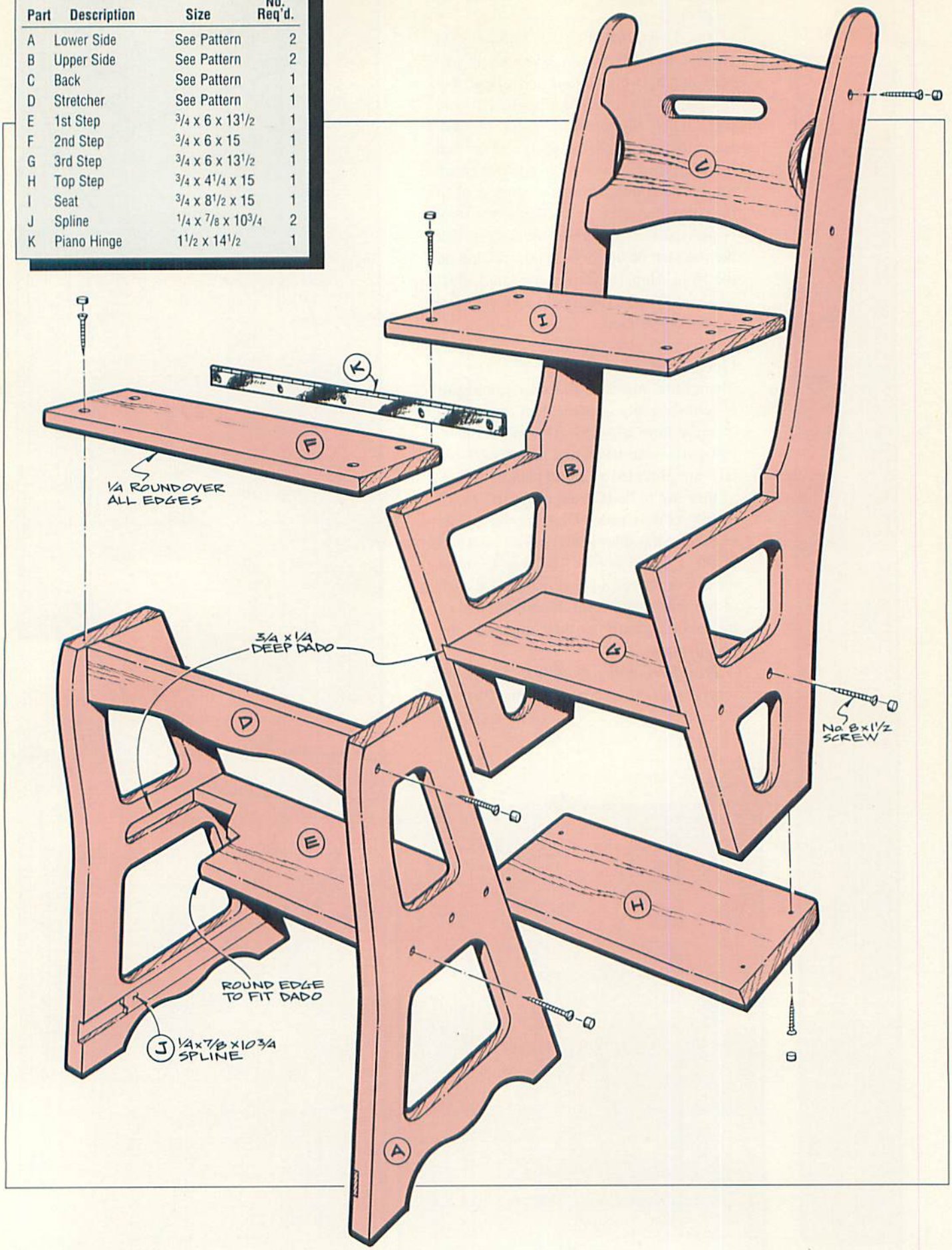






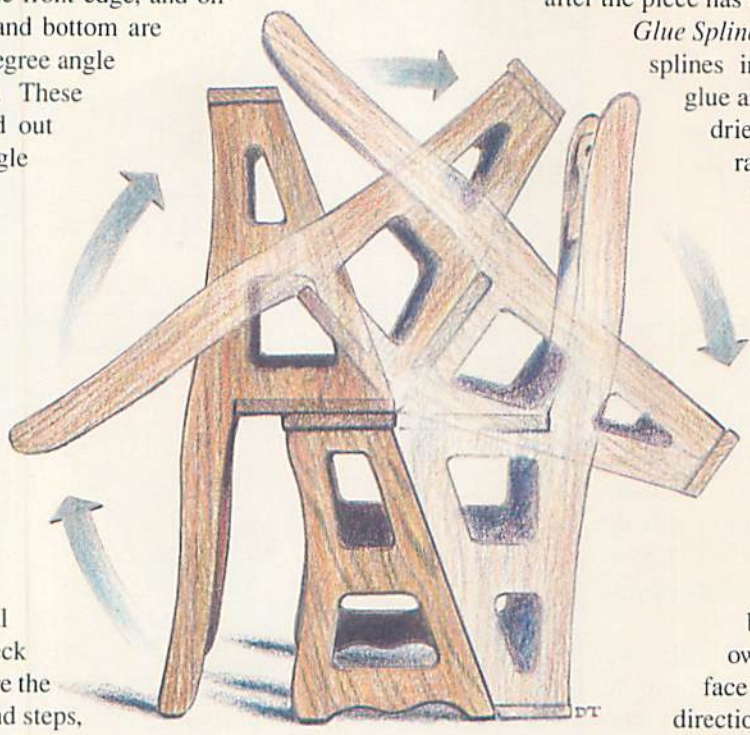
Bill of Materials
(all dimensions actual)

Part	Description	Size	No. Req'd.
A	Lower Side	See Pattern	2
B	Upper Side	See Pattern	2
C	Back	See Pattern	1
D	Stretcher	See Pattern	1
E	1st Step	3/4 x 6 x 13 1/2	1
F	2nd Step	3/4 x 6 x 15	1
G	3rd Step	3/4 x 6 x 13 1/2	1
H	Top Step	3/4 x 4 1/4 x 15	1
I	Seat	3/4 x 8 1/2 x 15	1
J	Spline	1/4 x 7/8 x 10 3/4	2
K	Piano Hinge	1 1/2 x 14 1/2	1



you have access to a photocopier that can enlarge, just enlarge the pattern until the squares on the grid pattern are 1 in. across. Because of the size of the pattern, you'll need to make the enlargement in several sections, and then cut and tape the sections together. The other option is to lay out a 1 in. square grid on some kraft paper, and then draw in the pattern of the two side parts. This really isn't difficult, since much of the pattern is just straight lines. On the upper section, the seat and steps are at 70 degrees to the front edge, and on the lower section the steps and bottom are positioned at this same 70 degree angle with respect to one edge. These straight lines are easily laid out with just a protractor or angle gauge and a straight edge.

The curved lines on the side sections aren't all that fussy, and they needn't be exactly the same profile as on the pattern. In fact, if you'd rather use a few heart-shaped cutouts (or some other shape that you like) in the sides instead of the cutout profiles that we show, you can dramatically change the look of the piece. About the only critical points that you'll need to check before cutting the sides out are the 70 degree angle of the seat and steps, the 15 1/4 in. and 17 1/2 in. dimensions from the seat flat to the bottom and top ends respectively of the upper side, and the 16 in. dimension from top to bottom on the lower side. If these dimensions check out, and if your seat and step stock is exactly 3/4 in. thick, when assembled, the chair will work exactly as intended, no trimming required.



Once you've cut the first part of each pair of sides from the bottom end of your source board, just use these as a template to trace the profiles of the remaining side parts on the top end of the board. Once cut out, you should have two pairs, an upper side pair and a lower side pair.

Cut the Step and Spline Dadoes: Next, you'll need to cut the dado grooves in the lower and upper sides for the 1st and 3rd steps, respectively. Use a router equipped with a 3/4 in. diameter mortising bit or straight cutter, and clamp a straight edge to the work piece as a guide. First, though, be sure to identify exactly which side of the workpiece you'll be cutting the dado into, and mark clearly with an "X". This is not the time to cut a step dado on the wrong side. Make the 1/4 in. deep step dadoes with at least two depth settings of the router bit, removing about 1/8 in. of stock each time. With the step dadoes cut, don't forget to also lay out and cut the spline dadoes in the lower sides. These splines add reinforcement to the short grain area of the lower sides that is most likely to break.

Make the Back and Stretcher: You can transfer the patterns for the back (C) and stretcher (D) using the same system that you used for the sides, or just cut these parts to their 13 in lengths, and come up with your own profiles for the curves. Again, use your imagination—perhaps carrying the heart theme through to the back and stretcher.

Make the Steps, Seat and Splines: The remaining parts—the steps (E, F, G, H), the seat (I) and the splines (J)—are cut from the remaining source board. Apply a 3/4 in. bull-nose to one edge of steps 1 and 3, to match the ends of the respective router-cut dadoes into which they fit, but don't apply the bevel to the opposite edge yet. That's best done with a hand plane after the piece has been assembled.

Glue Splines and Round Edges: Test-fit the splines into their mating dadoes, then glue and clamp. Once the splines have dried, and after sanding, a 1/4 in. radius round over is applied to most edges. You can hand-sand the radius, but it's quicker to just chuck a 1/4 in. radius roundover bit in the router or laminate trimmer, and use that to radius the edges.

Assembly

The step stool/chair is assembled with glue, screws and plugs. If you don't have a source for ready-made face grain plugs, buy a plug cutter and cut your own. By cutting the plugs from face grain, and matching the grain direction, your plugs will be all but invisible.

Before gluing and screwing, dry-assemble the two chair sections, and check that everything fits as intended. If all checks out, drill and counterbore for the screws and plugs, and final assemble. If you haven't used them yet, we recommend that you try the new square-recess screws. The screws pull in easily, and the driver bit never cams out. Drill pilot holes for the screws to avoid any chance of splitting the wood.

Finishing Up

With the two sections complete, and the plugs trimmed and sanded, now you can apply a finish. As shown, the piece has a light maple stain, followed with four coats of Deft Clear Wood Finish (lacquer).

Once the finish has dried, all that's left is to join the two sections with the piano hinge (K). Piano hinges (typically in 4 ft. lengths) are sold in most hardware stores, but if you can't find them locally, they can be ordered from Woodcraft (tel. 1-800-225-1153). Cut the piano hinge (with a hacksaw) to the required 14 1/2 in. length, and screw in place. Note that piano hinges are not mortised in, but are just face mounted to the edges to be joined.

If your side parts were cut as shown in the pattern, the step stool/chair should work perfectly—no adjustment needed. If one section or the other doesn't match up perfectly with the other, just sand as needed to even everything up.

Now, with the piece in its chair configuration, sit down and enjoy a brief rest in your latest creation. WWJ

Finger-Saving PLASTIC GROCERY BAG HANDLE

For better or worse, most supermarkets now offer plastic grocery bags. As you probably know, these bags have a pair of cutouts which serve as a carrying handle. However, those handles are not very comfortable in your hand, especially when the grocery clerk fills the bag with canned goods and you feel as though you're carrying a bag of bricks out to the car.

This little wooden handle can help. You simply slip the plastic bag handle into the groove and you instantly have a more comfortable grip. And since it's small enough to fit in a pocket or handbag, it's always ready to use.

Our thanks to James R. Warrick of Lancaster, Pennsylvania, for providing us with the idea. He makes them for a nearby woodworking crafts store where they have been selling quite well. While the chip carving is not necessary, it's a nice detail—and we think you'll find it easy and fun to do. It also will "jazz up" the handle a bit.

Make the Handle

Just about any wood you have available can be used. A piece of 3/4 in. thick stock measuring 1 1/4 in. wide by 16 in. long will provide enough material to make four holders.

After cutting the 16 in. long stock to size, round the edges using a router table and a 1/4 in. radius bearing-guided router bit. Be sure to keep your fingers well away from the bit as you make the cuts.

To cut the 1/4 in. wide by 1/2 in. deep groove, use the router table with a 1/4 in. diameter straight bit. Set the router table fence to locate the groove in the center of the 3/4 in. thickness. Make the first cut with the bit set to a height of 1/8 in., then raise the bit in 1/8 in. increments for successive cuts. Making the 1/2 in. deep groove in several steps reduces strain on the motor while keeping the bit from overheating and burning the wood.

Next, crosscut the stock into 4 in. lengths, then round over the ends to match the 1/4 in. radius cut earlier on the edges. A disk sander or a hand file will shape the radius in short order.

The drill press and a 1 in. diameter drum sander can be used to form the finger grip curves on the edge as shown. Mark the 1/8 in. depth and the 7/8 in. spacing, then slowly push the stock into the spinning drum to create each curve.

Chip Carve the Pattern

If you haven't tried chip carving before, we think you'll find this design to be surprisingly easy. However, before working on the handle, it's a good idea to get the feel of the technique by first practicing on some scrap stock.

Begin by securing the handle to your bench so that you'll have both hands free. Next, use a piece of carbon paper to

transfer the full-size carving profile directly to the stock. Don't worry if the profile doesn't match perfectly—after all, no two flowers grow exactly alike.

The carving is best done with a chip carving knife, although an X-Acto brand knife can also be used. Just be sure the knife has been well sharpened.

Carve the long stem first (see Fig. 1). Start at the top, holding the knife at a 45-degree angle (Step 1). Make the angled cut along the entire length, stopping it at the stem's bottom (Step 2). There's no need to press hard on the knife here, as the cut only needs to be about 1/64 in. deep.

Next, make a second cut on the stem, again starting at the top. This time, though, angle the blade at the opposite 45-degree angle to meet the first cut (Step 3). Stop the second cut at the bottom of the stem (Step 4). Now you need only remove the elongated chip (Step 5) to complete carving the long stem. The same basic five-step procedure is used to carve the leaves and the petals.

With the chip carving complete, you can now give the four handles a thorough sanding, finishing with 220-grit. A light stain should be added to highlight the carving. Allow the stain to dry, then apply a couple of coats of a good penetrating oil to complete the project.

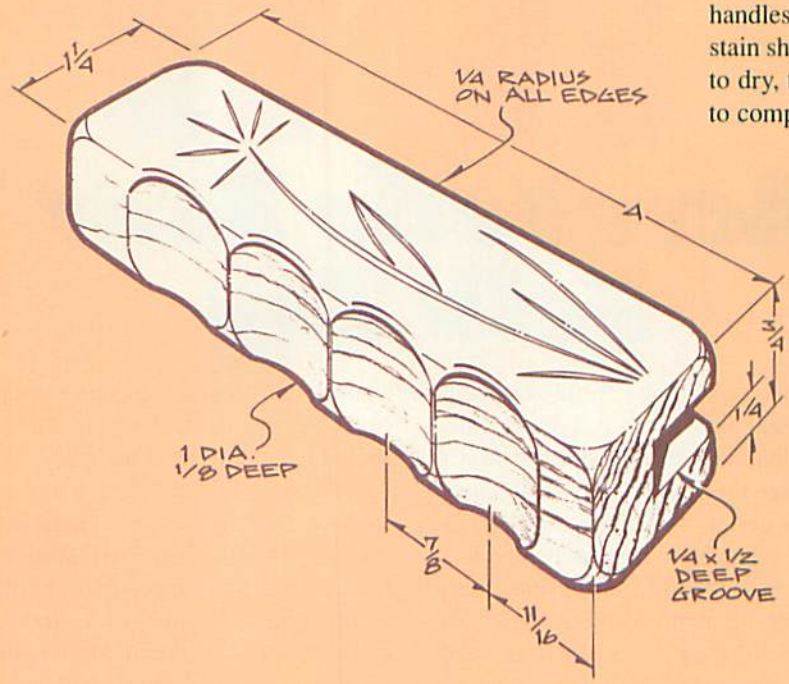
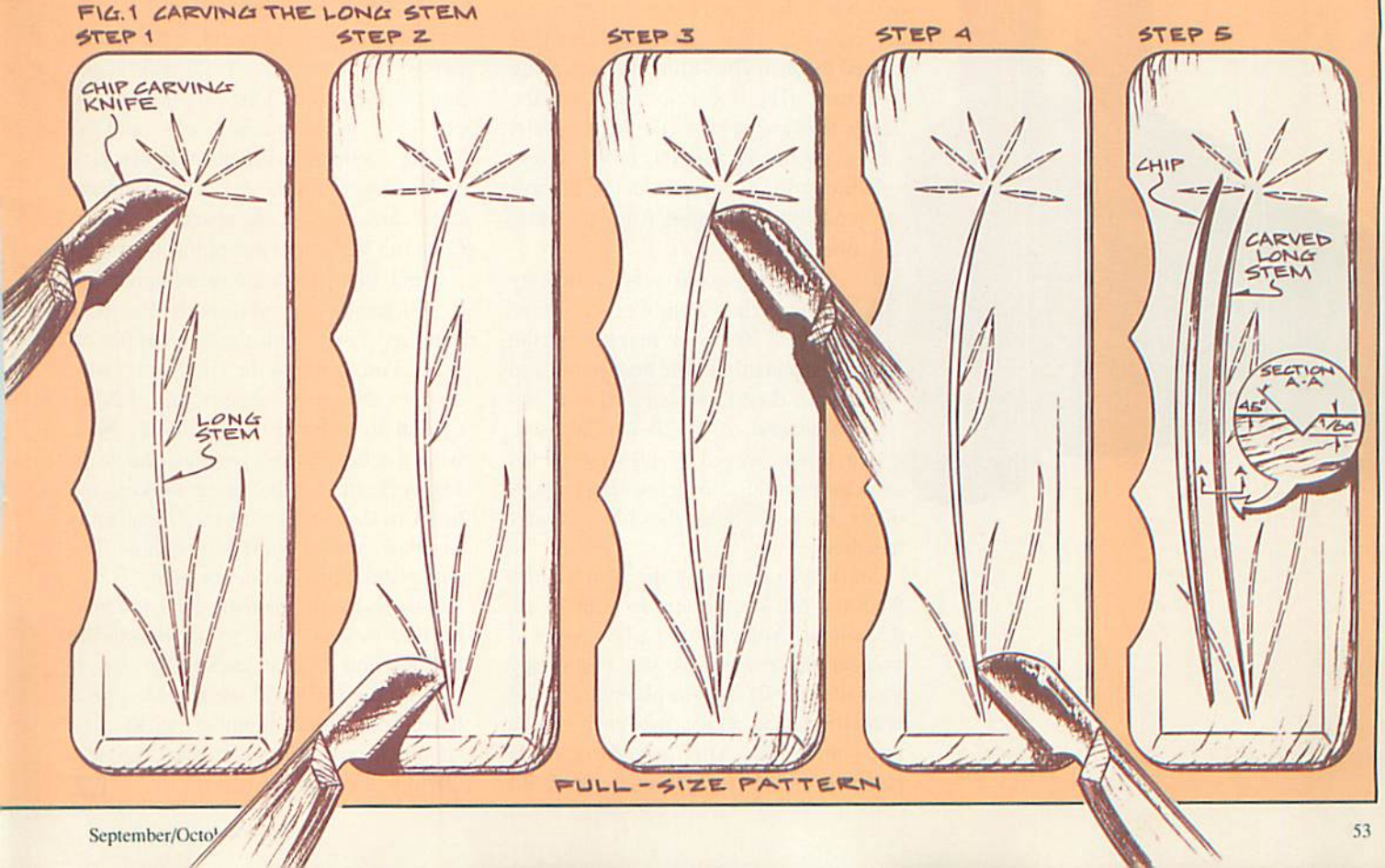
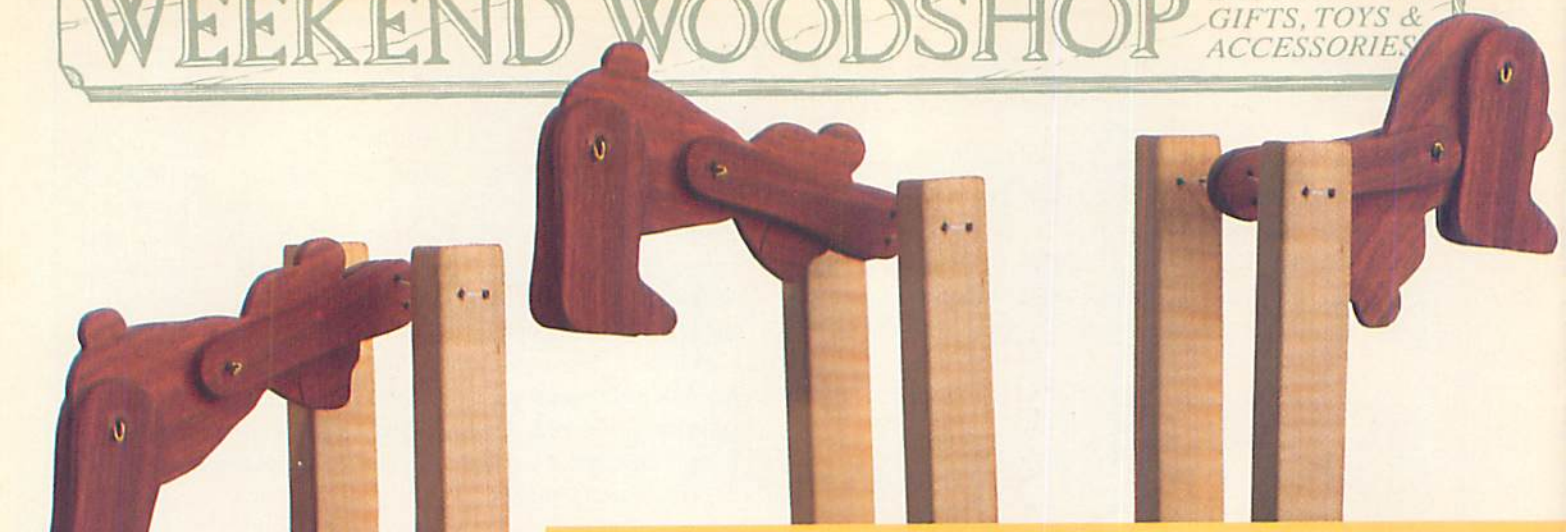


FIG. 1 CARVING THE LONG STEM





Acrobatic Bear Folk Toy

Folk toys similar to this Dancing Bear have been delighting children for generations. We won't try to trace their origin, but we do know that this design has changed little over the years. The basic concept behind this type of toy is the use of tension (from squeezing the bottom end of the sticks together) to straighten a pair of crossed strings. Since the toy is assembled so that when the bear is at rest the strings are crossed, when the strings are tensioned the bear flips around in acrobatic gyrations. The loose pinning of the bear's legs and arms to the body results in a positively unpredictable action, which in turn produces always predictable laughter from the little ones.

The toy shown was crafted by Connecticut woodworker Dave Moretti. He used maple for the arms, padauk for the bear parts, and a birch dowel, although almost any combination of woods can be used. Heavy duty waxed dental floss works great as the string, and a few short pieces of brass wire hold the bear's parts together.

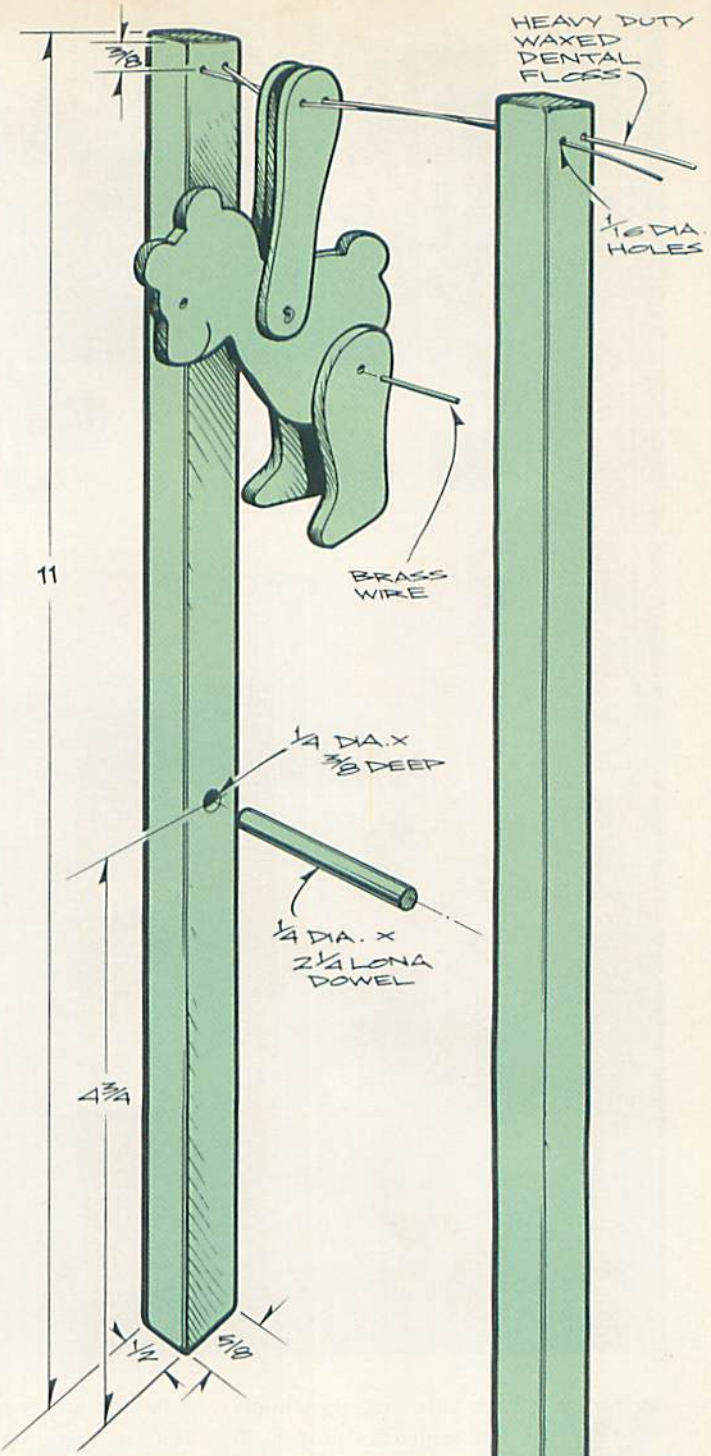
Start by transferring the bear's parts from the full-size pattern to your 1/8 in. thick stock. You can use carbon paper to transfer the pattern, or just photocopy the pattern and paste the photocopy right onto the stock. Make two each of the arms and legs. After transferring the patterns, use a 1/16 in. diameter drill bit to bore the various holes as indicated. Note that the string holes in the arms should be on-center 1/4 in. apart.

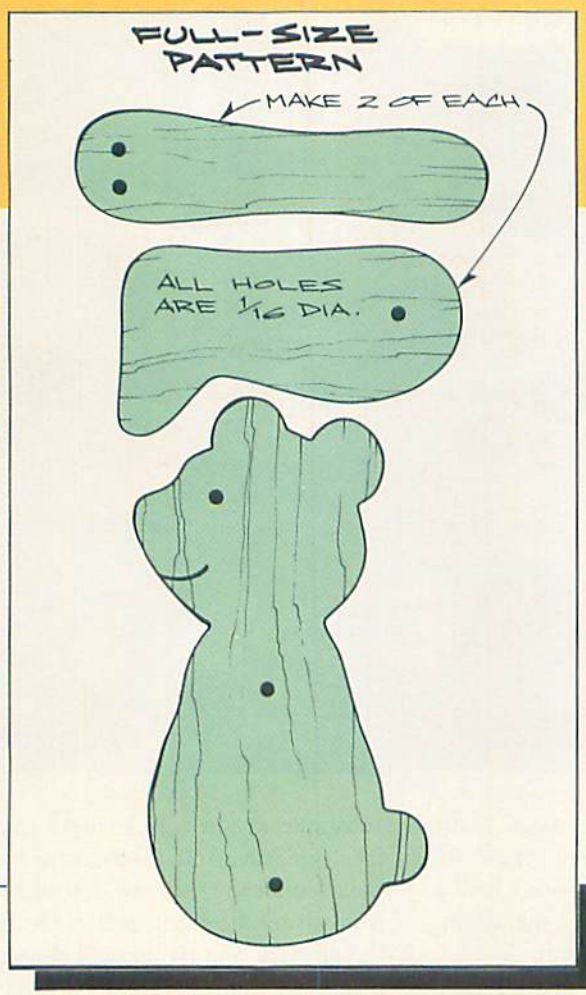
Although the scroll saw is the ideal tool for cutting the bear parts out, a coping or jeweler's saw will also work fine. By the way, if you don't have the ability to make 1/8 in. thick material, 1/8 in. thick stock, in several different wood species, can be ordered from Woodcraft (tel. 1-800-225-1153).

With the bear parts cut, next rip the pair of 1/2 in. thick by 5/8 in. wide sticks and cut the 2 1/4 in. long dowel. Drill the pair of 3/8 in. deep dowel holes, and the 1/16 in. diameter string holes in the stick ends. Make sure these 1/16 in. diameter holes are also 1/4 in. apart, on center. Glue the sticks and dowel together.

Sand, then finish the wood parts with a penetrating oil. Assemble the bear parts as shown with the two lengths of brass wire, bending the ends of the wire to hold the parts together, but making certain that the parts are loose. Now, with the bear in the position shown in Figure 1, thread the string through the holes in the sticks and bear, tie the ends together, and clip off any excess. The string should be loose, not tight.

Now, with the dancing bear toy held upright in your hand, try squeezing the bottom end of the sticks together. It won't take long and we're sure you'll have your bear spinning tricks that should insure him a berth on the next Olympic gymnastics team. WWJ


HEAVY DUTY WAXED DENTAL FLOSS
3/8
1/16 DIA. HOLES
11
BRASS WIRE
1/4 DIA.x 3/8 DEEP
1/4 DIA. x 2 1/4 LONG DOWEL
4 3/4
1 1/2
5/8


FULL-SIZE PATTERN
MAKE 2 OF EACH
ALL HOLES ARE 1/16 DIA.

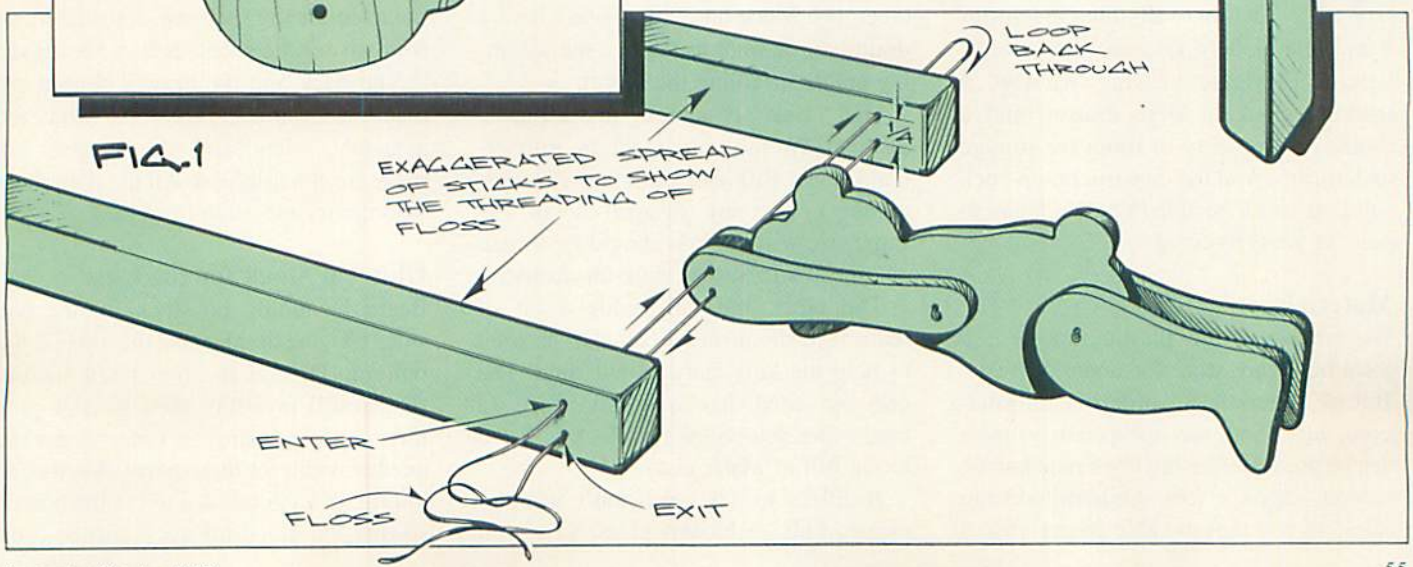

LOOP BACK THROUGH
1/4
EXAGGERATED SPREAD OF STICKS TO SHOW THE THREADING OF FLOSS
ENTER
FLOSS
EXIT

FIG. 1

Kids' Kitchen Playcenter

Sink and stove combo doubles as toy organizer

We think kids will enjoy hours of fun with this project. It features all the amenities found in a modern kitchen—an "oven" with a Plexiglas viewing window, a working clock, a large drawer, and a "sink" with plenty of room for storage underneath. And the construction is rock solid, so you'll be able to pass it along to kids for years to come.

Materials

We purchased the plastic faucet at a local hardware store for under $20 (see Bill of Materials for ordering information). Just about any inexpensive faucet can be used. Before buying a new faucet, though, check a few neighborhood tag sales, as you may be able to get a used one for just a couple of bucks. Some faucets come with a pop-up type drain assembly. Since our sink doesn't have a drain, you'll want to remove the assembly before installing the faucet.

Our "sink" is actually just a plastic dishpan. We used one made by Rubbermaid (see Bill of Materials for part number), but any dishpan about the same size will do. You should be able to get one at a hardware store for about $4.

The clock not only adds a bit of realism to the piece, it can also be used to help the kids learn to tell time. The one we used has a plastic face (a mail-order source for the clock is listed in the Bill of Materials).

Needless to say, you don't want to expose kids to broken glass, so if you substitute another clock, make sure the face is plastic. And, for the same reason, the oven viewing window must be made from an acrylic sheet such as Plexiglas.

The back and the drawer bottom are made from birch plywood, while the adjustable shelf and the burners are made from hardboard. All the remaining wood parts are made from pine.

Glue Up Stock for the Case

Begin by gluing up stock for the two sides (A), the divider (B), the top (C), the bottom (D) and the two fixed shelves (E). You'll probably need to edge-glue three or four boards in order to get the needed width for these parts. When edge gluing, it's a good idea to cut the boards so that the glued-up stock will be a bit

wider and longer than necessary.

If you don't like the idea of gluing-up all those boards, check to see if your lumberyard carries preglued wide pine stock. It is generally sold in widths ranging from 12 in. to 24 in., in 2 in. increments. Keep in mind, however, that this stock tends to run a bit under 3/4 in. thick. For tight joints, you'll need to adjust the width of your dadoes and rabbets to match the actual thickness of the stock.

To edge glue, apply a thin coat of glue to the mating surfaces, then clamp firmly with bar or pipe clamps and set aside to dry. No need to add dowels or splines here, as this joint matches long grain-to-long grain, a joint that's as strong as the wood itself. Should the edges start to slide out of alignment, clamp a few waxed cleats (Fig. 1) across the boards every 8 in. or so. The cleats are made from hardwood stock that measures about 1 1/4 in. square by 18 in. long.

Cut the Case Parts

When dry, remove the clamps and cleats, then cut each part to length and width. It can be a problem to crosscut wide parts like these on most table saws. If you have one, a table saw cutoff table will make the job a lot easier. Or, you can make a Circular Saw Crosscut Jig like the one shown in Fig. 2.

Use a scraper to remove any glue squeeze-out, then give the parts an initial sanding with 80-grit, followed by 120-grit, sandpaper. When sanding, be sure to remove the cutter marks made by the thickness planer. If not removed, these marks will give the boards an unsightly "washboard" look that becomes especially apparent when the wood is stained.

Cut the Rabbets and Dados

Next, lay out and mark the location of the various dadoes and rabbets that will be cut in the sides, divider, top and bottom.

Note that a 1/4 in. deep by 3/8 in. wide rabbet is cut in the back edge of the sides, top and bottom. This rabbet can be cut now, using the table saw, the rip fence and a dado head cutter.

Use the router to cut the 1/4 in. deep by 3/4 wide through dadoes in the sides, divider, top, and bottom. Also use the router to cut the 1/4 in. deep by 3/4 in. wide rabbets on each end of the top. These dadoes and rabbets (there are ten of them in the case parts) can best be done using the jig shown in Fig. 3. However, if you'd rather not make the jig, you can simply clamp a straightedge to the stock in order to guide the router for each cut. Just make sure that the straightedge is clamped square to the edges of the parts.

Lay out and mark the 2 in. high by 2 3/4 in. wide notch in the lower front corner of each side. A band saw or saber saw will cut out the notch in short order.

Also, lay out and mark the location of the sink cutout in the top. It's best to have the sink (JJ) on hand to make sure the fit will be right. To make the cutout, first bore a starter hole in the waste portion of the stock, then use a saber saw to make the cut all around.

With the faucet (KK) at hand to serve as a guide, mark the location of the two faucet holes. Once marked, bore them out on the drill press.

Bill of Materials
(all dimensions actual)

Part	Description	Size	No. Req'd.
	Case		
A	Side	3/4 x 17 1/4 x 23 1/2	2
B	Divider	3/4 x 17 x 21	1
C	Top	3/4 x 17 1/4 x 36 1/4	1
D	Bottom	3/4 x 17 1/4 x 35 1/4	1
E	Fixed Shelf	3/4 x 17 x 17 1/2	2
F	Kickplate	3/4 x 2 x 36 1/4	1
G	Apron	3/4 x 7 3/4 x 17	1
H	Bracket	3/4 x 3 1/4 x 4	2
I	Glue Block	3/4 x 3/4 x 2	8
J	Back	1/4 x 21 1/4 x 35 1/2	1
K	Top Front Edging	3/4 x 1 x 37 3/4	1
L	Top Side Edging	3/4 x 1 x 18	2
M	Backsplash	3/4 x 5 1/2 x 37 3/4	1
N	Adjustable Shelf	1/4 x 14 1/2 x 16 7/8	1
O	Adjustable Shelf Front	3/4 x 3/4 x 16 7/8	1
P	Adjustable Shelf Cleats	1/4 x 3/8 x 14 1/4	6
	Door		
Q	Door Stile	3/4 x 3 1/2 x 14 1/2	2
R	Door Rail	3/4 x 4 x 11*	2
S	Door Window	1/4 x 7 x 10 1/2	1
T	Door Window Retainer	1/4 x 1/4	3 ft.
	Drawer		
U	Drawer Front	3/4 x 5 x 17	1
V	Drawer Side	1/2 x 5 x 16 1/4	2
W	Drawer Back	1/2 x 4 1/2 x 16 1/2*	1
X	Drawer Bottom	1/4 x 16 x 16 1/2	1
Y	Drawer Stop	1/4 x 1 x 2 1/2	2
	Accessories		
Z	Pull/Towel Bar End	3/4 x 2 x 2	6
AA	Pull/Towel Bar	7/8 dia. by 12 in. long	3
BB	Door Stop	3/4 x 1 1/2 x 3	1
CC	Small Burner	4 dia. by 1/4 thick	2
DD	Large Burner	5 1/2 dia. by 1/4 thick	2
EE	Knob Peg	(see detail)	4
FF	Knob	1 3/4 dia. by 1/2 in. thick	4
GG	Knob Handle	1/4 x 1 1/8 x 1 3/4	4
HH	Magnetic Catch	1/2 x 3/4 x 1 7/8	1
II	Hinge	1 1/2 x 1 3/8	2
JJ	Sink**	11 1/2 x 13 1/2 x 5 1/4	1
KK	Faucet***	4 in. centers	1
LL	Clock****	2 13/16 dia.	1
MM	Clock Retainer	3/8 x 3 x 4 1/2	1

* Length includes tenons/tongues
** Rubbermaid No. 2951
*** Peerless Model No. 7600-N
**** Available from Klockit, P.O. Box 636, Lake Geneva, WI, 53147; tel. 1-800-556-2548. Specify promo number 71178; price is $9 postpaid.

Assemble the Case

The sides, divider, top, bottom, and fixed shelves can now be assembled using glue and countersunk wood screws. Begin by joining the two fixed shelves to the divider. Then, add the bottom, followed by the two sides, and finally the top. Check the case for squareness and make adjustments if necessary. Once all looks okay, set aside to dry.

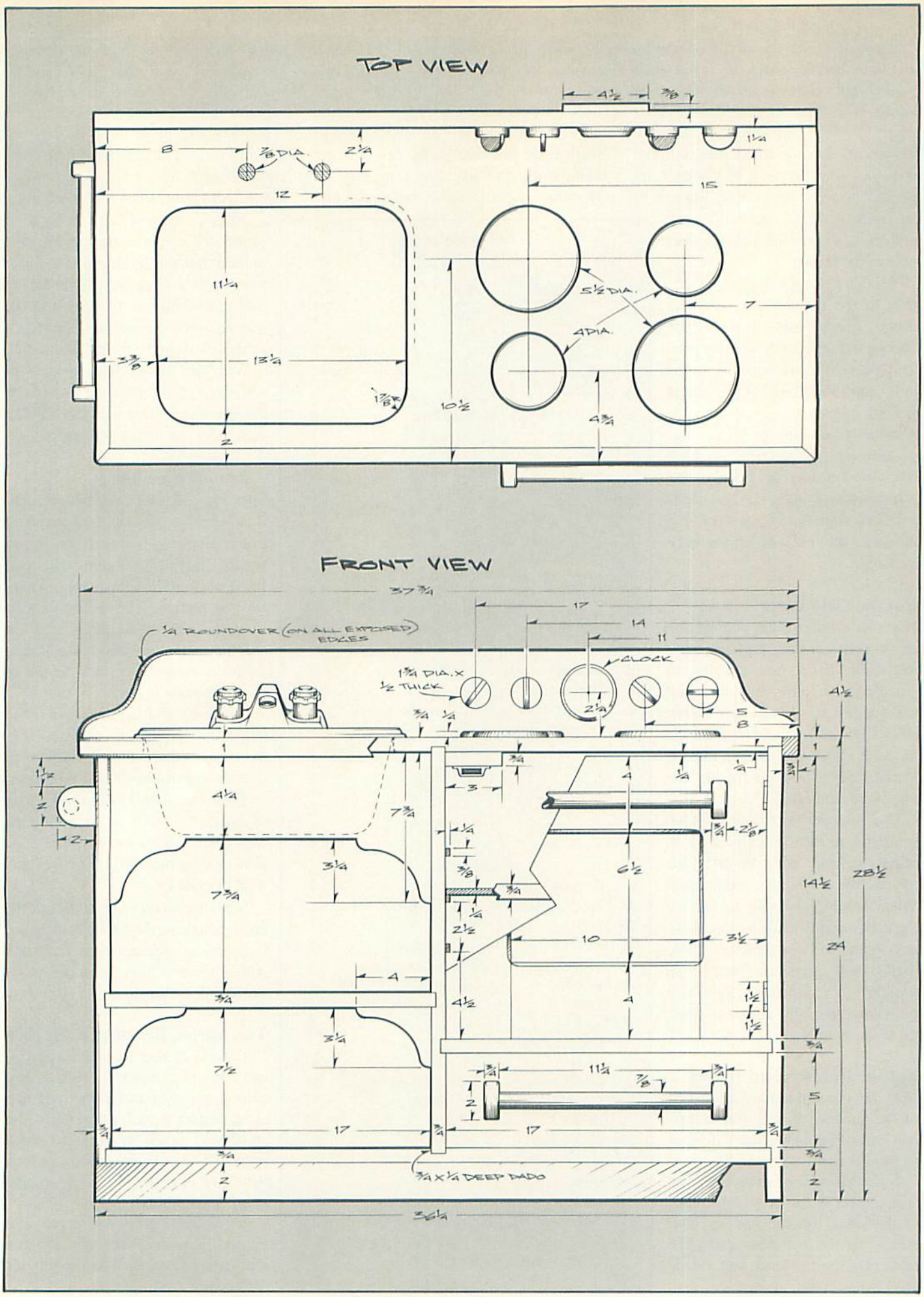
When dry, cut the kickplate (F) to length and width, then assemble it to the front edge of the sides with countersunk wood screws. When cutting the kickplate to length, it's best to cut it about 1/32 in. long on each end. Then, after assembly, you'll be able to sand the ends perfectly flush with the sides.

Next, use wood plugs to fill all the countersunk screw holes in the case. Use glue to secure them in place. Allow to dry, then sand the plugs flush with the surface.

The Apron, Brackets & Edging

Cut stock to size for the apron (G) and the two brackets (H). Using carbon paper, transfer the full-size curve pattern to each of the parts (the apron and brackets share the same profile). Cut each one to shape with a band saw or saber saw, and sand the sawn edges smooth.

Glue and clamp the apron and brackets in place. When dry, add glue blocks (I) behind each part to provide further support.


TOP VIEW
4½
⅜
1¼
8
⅜ DIA.
2¼
12
15
11¼
5½ DIA.
7
4 DIA.
3⅜
13¼
1⅜ R
10½
4¾
2
FRONT VIEW
37¾
17
14
11
¼ ROUNDOVER (ON ALL EXPOSED EDGES)
CLOCK
1¾ DIA. x ½ THICK
2¼
4½
5
8
1½
2
4¼
7¾
3¼
7¾
7½
3¼
4
6½
10
3½
4½
4
1½
1½
11¼
⅜
2
5
17
17
¾ x ¼ DEEP DADO
14½
28½
24
36½

Now, cut enough stock for the top front edging (K) and the two top side edgings (L). You'll need about 76 in. length for the three parts. Miter the front corners as shown, then attach the front edging with glue and countersunk finishing nails.

The side edgings are also attached with countersunk finishing nails. However, to allow for the inevitable wood movement of the sides, no glue is used on the side edgings. The nails allow the sides to move, yet they will hold the edging securely in place. After all the nails have been countersunk, fill the holes with wood putty and sand smooth.

Make the Adjustable Shelf

We used 1/4 in. thick hardboard (Masonite) for the adjustable shelf (N), although plywood can also be substituted. Cut it to length and width before sanding the edges smooth.

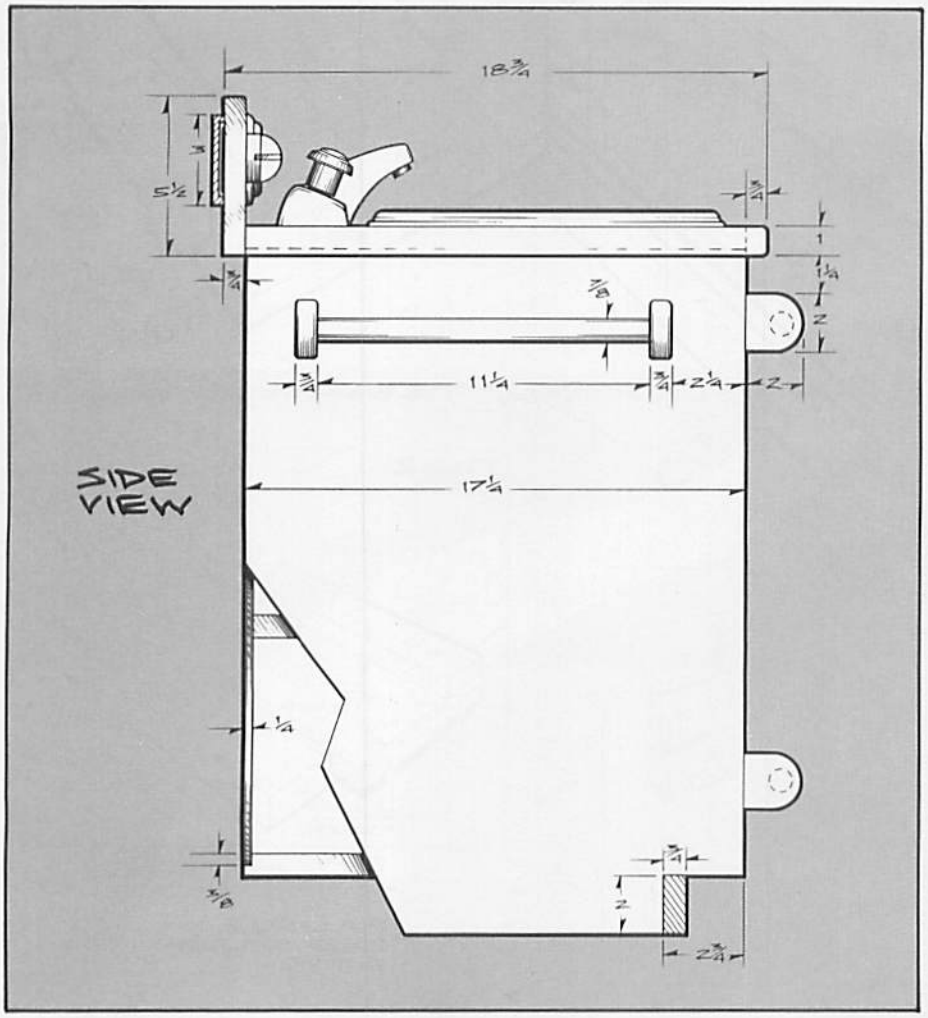
Next, cut the adjustable shelf front (O) to size, then use the dado head to make a 1/4 in. wide by 1/2 in. deep groove along one edge. Add glue to the groove and attach it to the front edge of the adjustable shelf.

Now, cut the six adjustable shelf cleats (P) to size and give then a good sanding. Use five or six small brads (or finishing nails) to secure each one to the inside of the case as shown. As with the side edging applied earlier, there is no need to apply glue here.

Make the Door

Measure the actual opening for your door, then cut the two stiles (Q) and the two rails (R) to size. Use the router table and a 1/4 in. diameter straight bit to cut the 1/4 in. wide by 1/2 in. deep by 3 1/2 long mortise in each end of the stiles. To save strain on the motor, and to keep the bit from overheating, you'll want to make the 1/2 in. deep cut in four passes, with each pass removing about 1/8 in. of material. Once cut, use a chisel to square the rounded end of the mortise.

The table saw and dado head are used to cut the 1/4 in. thick by 1/2 in. long tenon on the ends of the rails. Use a dovetail saw to cut the 1/2 in. by 1/2 in. notch in each tenon as shown, then check for a good fit in the stile mortises.



Assemble the door as shown. Use glue on all mating surfaces and clamp firmly. Check for squareness and, if all looks okay, set aside to dry.

Now, cut the rabbet for the Plexiglas door window (S). Use the router and a 1/4 in. bearing-guided rabbeting bit to cut the 1/4 in. by 1/2 in. rabbet all around the inside of the door.

Cut the Plexiglas door window to fit the opening in the door. For the safety reason mentioned earlier, don't use glass for this part. Cut the retainers (T) to secure the Plexiglas, but don't attach anything yet.

Make the Drawer

The drawer is made next. The front (U) is made from 3/4 in. thick stock, while the two sides (V) and the back (W) are made from 1/2 in. thick stock. The bottom (X) is 1/4 in. plywood.

Cut the various rabbets, dadoes and grooves in the front, back and sides, then assemble with glue and clamps. When dry, cut the bottom to length and width, and slide it into place from the back of the drawer. Secure it with two or three screws driven up through the bottom and into the lower edge of the drawer back.

Check the drawer for a smooth sliding fit. If all is satisfactory, mark the location of the two drawer stops (Y) and glue them in place. Properly located, the drawer stops will stop the front of the drawer so that it is flush with the front of the case.

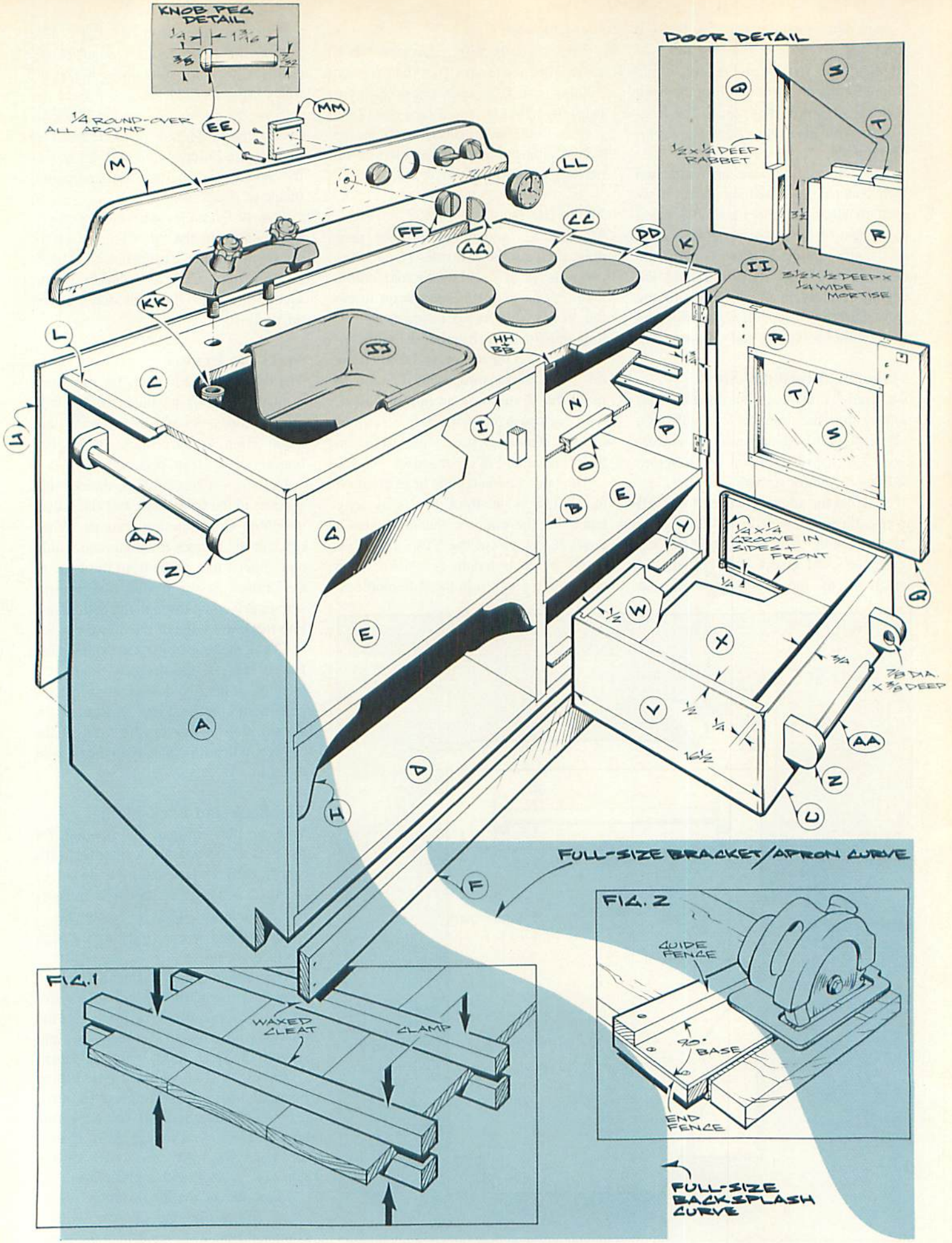
The Back and Backsplash

You can now measure the opening for the back (J). Allow for a snug fit in the rabbet, then cut it to size. The jig shown in Fig. 2 will once again come in handy for crosscutting. Use 3/4 in. by no. 6 flathead wood screws to secure the back in place.

The backsplash (M) is next. Cut it to size, then use carbon paper to transfer the full-size pattern to the stock. Cut the curves with a band or saber saw, and smooth the sawn edges with sandpaper.

The clock (LL) we used (see Bill of materials) is designed to press fit into a 2 3/8 in. diameter hole. If you substitute another clock, you may need to change the hole size. As mentioned earlier, don't use a clock with a glass face.

Mark the centerline location of the clock and scribe the opening with a compass. Bore a starter hole in the waste


KNOB PEG DETAIL
DOOR DETAIL
¼ ROUND-OVER ALL AROUND
½ x ¼ DEEP RABBET
3½ x ½ DEEP x ¼ WIDE MORTISE
¼ x ¼ GROOVE IN SIDES + FRONT
⅜ DIA. x ⅜ DEEP
FULL-SIZE BRACKET/APRON CURVE
FIG. 1
WAXED CLEAT
CLAMP
FIG. 2
GUIDE FENCE
90° BASE
END FENCE
FULL-SIZE BACKSPLASH CURVE

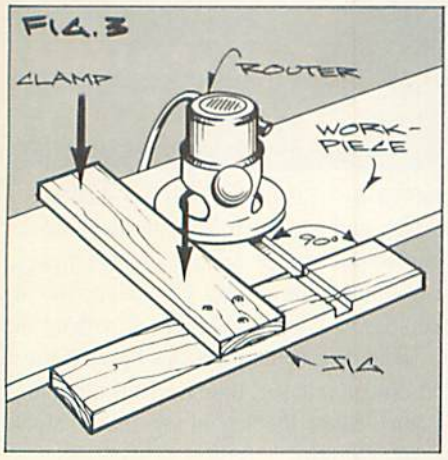
area, then use the saber saw to cut out the opening. After sanding smooth, check the clock for a snug fit.

The clock retainer (MM) is added to keep curious fingers from pushing the clock out of the hole. Since our clock protruded out the back of the splashboard about 1/16 in., a relief area had to be cut. A sharp chisel cut the relief area in short order.

The knob pegs (EE) can be turned to the dimensions shown, or you can use toy wheel pegs which are sold by most of the woodworking mail-order outfits.

Mark the location of the knob holes on the back side of the backsplash. At the marked points, counterbore a 1/2 in. diameter by 1/4 in. deep hole to accept the head of the knob peg. Now, centered on each counterbore, drill a 1/4 in. diameter through hole for the shank of the knob peg.

To make the four knobs (FF), you'll need a piece of stock measuring 1/2 in. thick by 2 in. wide by about 10 in. long. Mark a lengthwise centerline on one side of the stock, then use the compass to scribe four 1 3/4 in. diameter circles along the centerline. Now, use the table saw and dado head to cut a 1/4 in. wide by 1/4 in. deep lengthwise groove down the



center of one side. Then, at the centerpoint of each scribed circle, bore a 1/4 in. diameter through hole. To complete the knobs, cut out the scribed circle with a band or saber saw, and sand smooth.

Next, cut the four knob handles (GG) to shape and glue them into the knob grooves. Sand thoroughly and, for now, set them aside.

Bars and Burners

Make the six pull/towel bar ends (Z) as shown. You'll need to bore a 7/8 in. dia. by 3/8 in. deep hole in each one to accept

the pull/towel bar (AA). The bars are made from 7/8 in. dia. dowel stock cut to 12 in. lengths. Give the parts a thorough sanding, but don't mount them yet.

With a compass, scribe the small burners (CC) and the large burners (DD) on a piece of 1/4 in. thick hardboard. Cut them to shape with the band or saber saw and sand smooth.

Sand and Finish

Use the router and a 1/4 in. radius bearing-guided round-over bit to round all the exposed edges, then give the entire case and all the various components a final sanding with 220-grit sandpaper.

As shown in the photo, the playcenter has both stained and painted surfaces. (Note that the pull/towel bars on the door and drawer are painted, while the one on the side of the case is stained.) It's best to do all the staining first.

For a stain, we applied two coats of Minwax Puritan Pine Wood Finish, allowing the first coat to dry overnight before adding the second coat. Two coats of a clear water-based polyurethane provided the final finish.

A coat of primer was applied to all the surfaces to be painted, then we brushed on two coats of enamel paint (almond colored) to the top, backsplash, door and drawer. Following that we added two coats of satin black latex paint to the kickplate, knobs and burners.

Final Details

The backsplash can now be attached to the back edge of the top with six 1 1/2 in. by no. 8 flathead wood screws. When it is secured, insert the clock and attach the clock retainer with four small screws.

Add the pull/towel bars and ends to the door, drawer and left side of the case as shown. A pair of 2 in. long by no 8 wood screws in each end will provide plenty of strength.

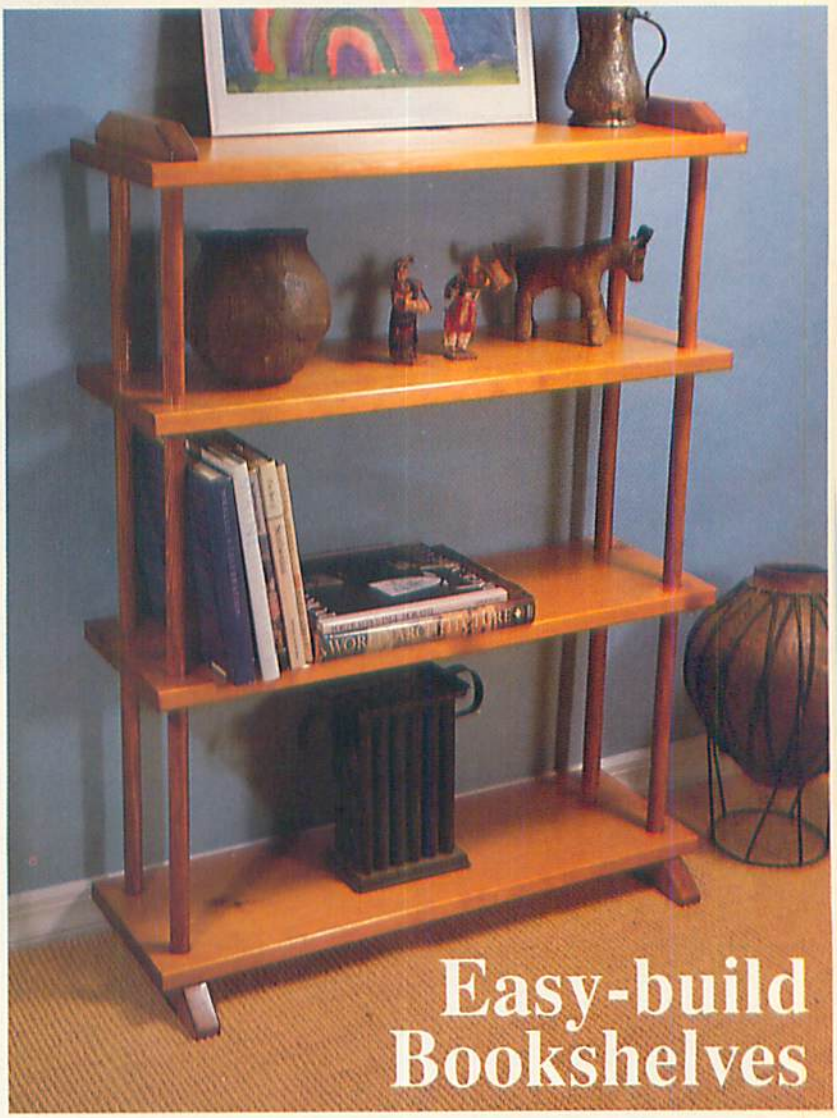
Apply a coat of glue to the knob holes, then assemble the knob pegs to the knobs as shown in the exploded view. Be sure to wipe away any excess glue, otherwise the knobs won't turn.

Next, add the Plexiglas door window. The Plexiglas is secured by the four retainers which are tacked in place with several small brads. To avoid splitting the retainers, be sure to predrill each of the brad holes.

Attach the hinges (II) and assemble the door to the case. Check the fit, then add the door stop (BB) and the magnetic catch (HH).

Use the two locking nuts supplied with the faucet to secure it to the top. Finally, use contact cement to glue the four burners in place. The cement will adhere better if some of the paint under each burner is scraped away to expose bare wood. Finally, to complete the project, drop the sink in place and add the drawer.

Easy-build Bookshelves



Bookshelves can be as basic as boards laid across concrete blocks, or stacks of old apple crates. But if you'd like something that's both simple and elegant, then a bit more thought is required. Our easy-build bookshelves combine several important features—simple design, low cost, and knock-down capability.

A Flexible Design

We show a 4-shelf unit with 3 ft. long shelves, but using the same basic concept, you can build a unit of just about any length, height or shelf width. We've seen units sized to fill an entire wall, that quickly turn a room into a mini library. For a longer unit, just add central legs, spaced no more than about 3 ft. apart. Although our shelf unit has evenly spaced shelves, and is sized for hardcover books, you can custom-size the shelf width and spacing for just about any purpose—from oversize photo albums or an encyclopedia set, to paperbacks. However, if your unit height exceeds about 5 ft., it's a good idea to anchor the top of the shelf unit to the wall with a few angle brackets, to avoid any possibility of it tipping over.

Cut Parts to Size

The What To Buy illustration shows exactly what you'll need to buy to build the shelf in the photo. The four legs (A) are obtained from two 8 foot lengths of $1\frac{1}{8}$ in. diameter closet pole. The four shelves (B) can be crosscut from a $\frac{5}{4}$ in. pine board measuring $11\frac{1}{4}$ in. wide by 12 ft. long (don't worry about the length lost from the saw kerfs—it won't be missed). The actual thickness of $\frac{5}{4}$ stock is about $1\frac{1}{8}$ in.

The foot and cleat parts (C, D) are obtained from a single $\frac{3}{4}$ in. thick board measuring $4\frac{1}{2}$ in. wide by 4 ft. long. As illustrated, crosscut the board into two 24 in. lengths, then glue up the two halves in a stack lamination. Rip the laminated board down the center, crosscut to separate the cleat and foot parts, then make rips and crosscuts to establish final sizes. But don't cut the bevels on the feet or cleats yet. Temporarily clamp the feet back together as indicated to bore the $\frac{3}{4}$ in. diameter holes establishing the ends of the foot reveal. Use a jigsaw or band saw to remove the waste between the holes, then smooth the cut line with files and sandpaper. A $\frac{1}{4}$ in. diameter by 3 ft. long dowel will be more than enough to yield the shelf pins (E).

Drill the Holes

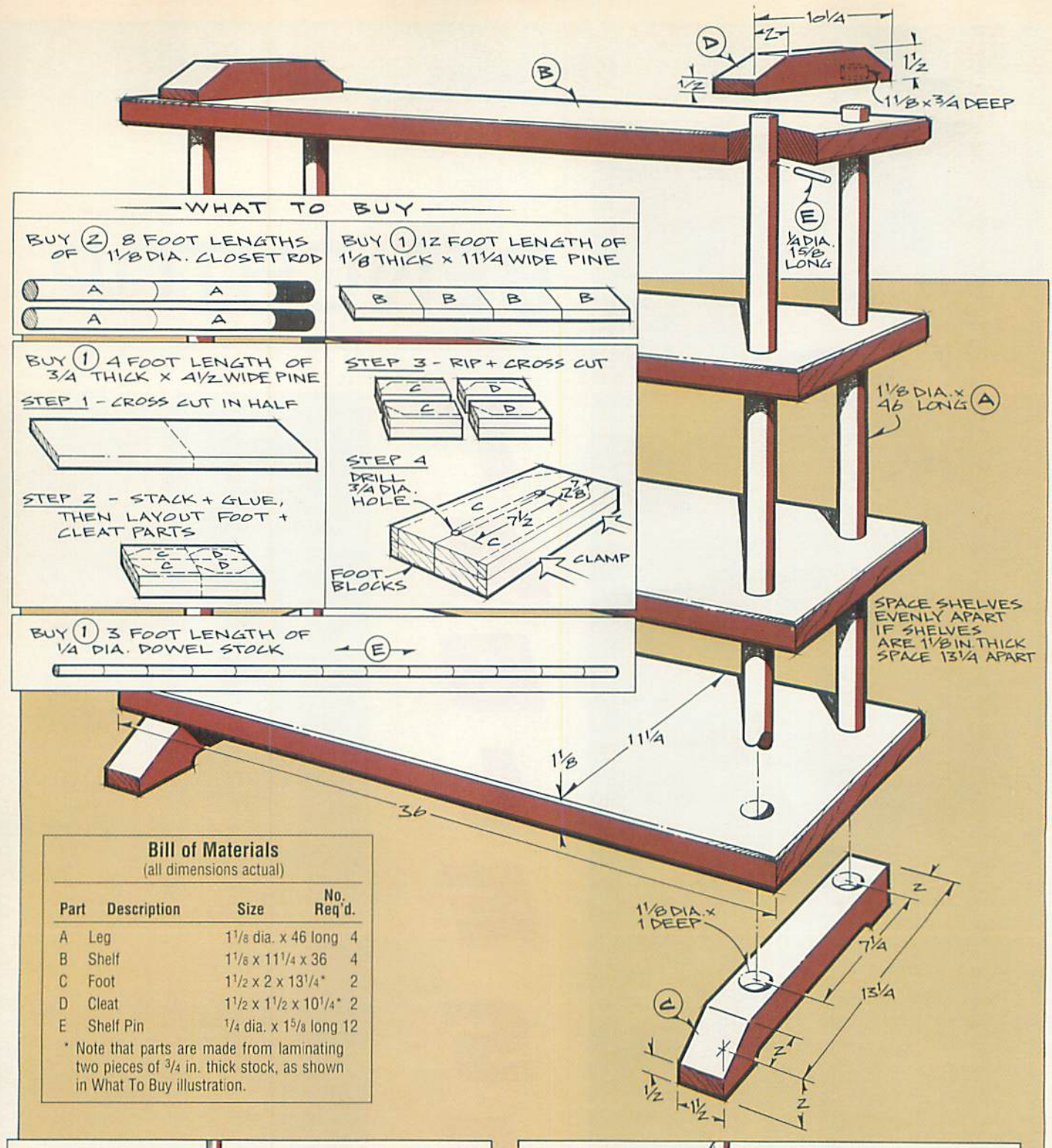
With your parts cut to size, next bore the holes in the shelves, feet and cleats for the legs, and in the legs for the shelf pins. A pair of simple jigs come in handy for making the larger holes. For the holes in the shelves, make a right-angle jig, as shown in Figure 1, then clamp the jig to the drill press so the bit center point is 2 in. from the jig legs. A Forstner bit is the best type of bit for boring the shelf holes, since it cuts smooth and clean, with little tearout. However, check that the hole size will be right for the closet rod that you purchased. Closet rod can vary considerably from the specified diameter, and since the shelf assembly is a friction fit, you should avoid sloppy, oversize holes. If your closet rod is off-size, consider using an adjustable drill bit, and set the cutter to equal your closet rod diameter.

For the holes in the feet and cleats, locate the hole center points, then clamp the part to the drill press table before making each hole. Note that the foot holes are drilled 1 in. deep, and the cleat holes are $\frac{3}{4}$ in. deep. Use a simple V-block jig to hold the legs while you bore the $\frac{1}{4}$ in. diameter shelf pin holes (Figure 2). Lay out the hole locations on one leg, then transfer the marks to the three remaining legs. Slide the leg along the V-block, drilling the holes at the index points.

Finishing Up

All that's left is to cut the bevels on the foot and cleat parts, chamfer the edges of these parts and the shelves, and apply a finish. The parts should be finished before the shelves are assembled. We used Minwax's Puritan Pine stain, and followed with several coats of penetrating oil.

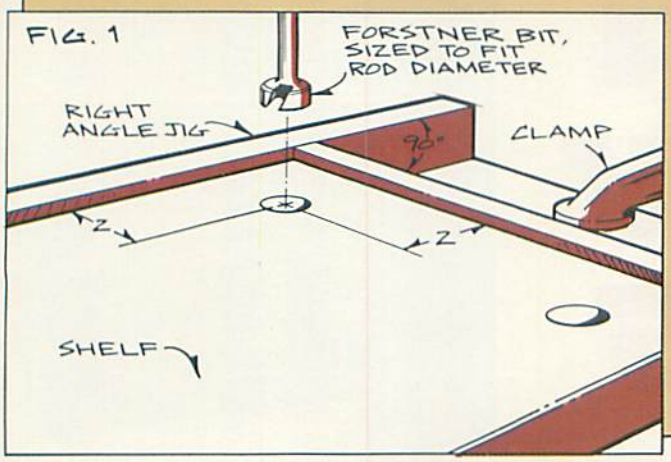
To assemble the bookshelf, mount the legs to the feet, then slide the shelves on one by one, adding the pins to provide the three upper shelves with support. Finally, press the cleats into place over the leg ends. In use, you'll find that the more books—and weight—that are added to the shelves, the sturdier the assembly becomes. Since no glue is used, the bookshelf can be quickly knocked down for moving or storage.

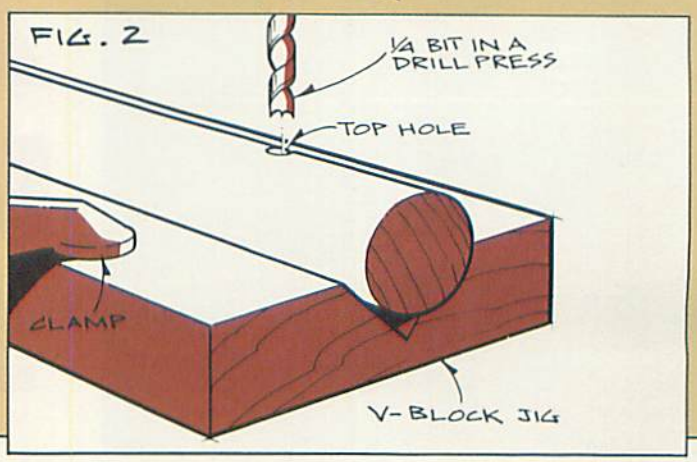


Bill of Materials
(all dimensions actual)

Part	Description	Size	No. Req'd.
A	Leg	1⅛ dia. x 46 long	4
B	Shelf	1⅛ x 11¼ x 36	4
C	Foot	1½ x 2 x 13¼*	2
D	Cleat	1½ x 1½ x 10¼*	2
E	Shelf Pin	¼ dia. x 1⅝ long	12

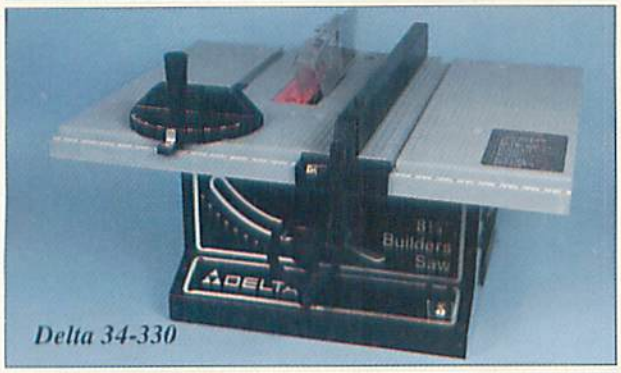
* Note that parts are made from laminating two pieces of ¾ in. thick stock, as shown in What To Buy illustration.



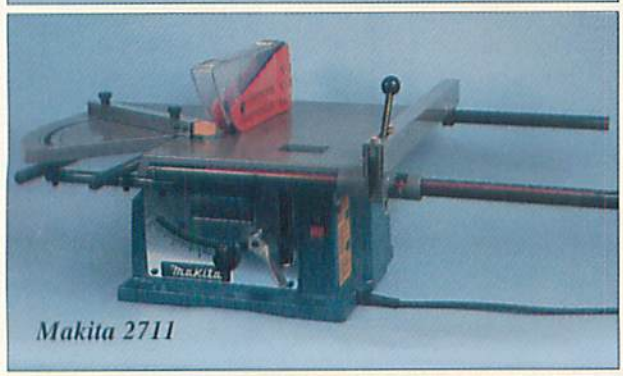


BENCHTOP TABLE SAWS

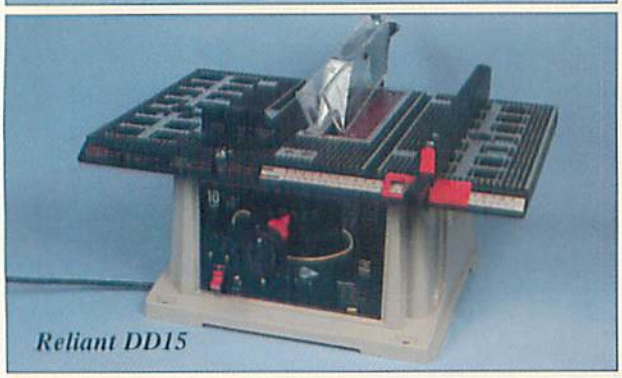
AMT 4810

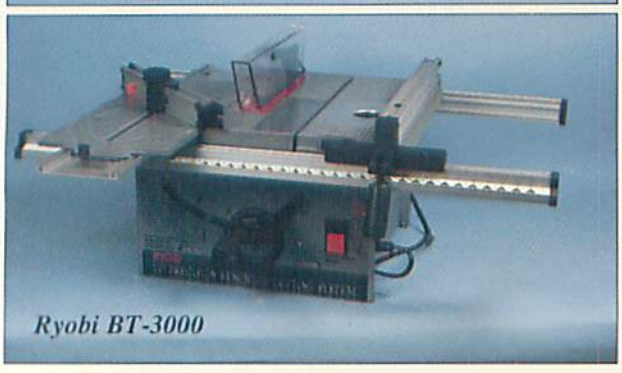


Delta 34-330



Makita 2711

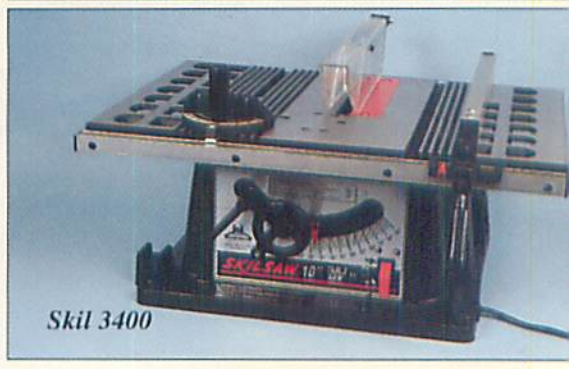

Reliant DD15


Ryobi BT-3000

Ryobi BT-2500

Sears 22162

Sears 22172



Skil 3400

Better quality and new features add up to more buzz for the buck

by Jim Barrett

It's an old saw, but true: the table saw is the heart of the woodworker's shop. And for many of us, nothing less than a full-size stationary machine with plenty of power and an acre of table surface will do. Then there are guys like me who simply can't find the shop space for even a modest sized floor model. My small backyard shop consists mainly of shelves and cabinets for temporary storage of the various tools and other products tested for reviews such as this one, leaving precious little space for my own woodworking tools and machinery. As a result, I've come to rely on my little Ryobi BT-2500 benchtop saw, along with other scaled-down benchtop tools and portable power tools, to do my woodworking. If, like me, you can't sacrifice the space for a full-sized table saw, a benchtop model just might be the ticket. And, if you think all benchtop table saws are underpowered toys used for building dollhouse furniture, many of the new ones on the market may change your mind.

For this article, I tested nine units offered by the major tool manufacturers and importers, as shown in photos. Two saws I did not test were the 10 in. Delta 36-510 and the 8 1/4 in. Makita 2708W. A Taiwanese-made saw, the Delta is nearly identical to the Reliant, pictured. Reliant, by the way, is the proprietary name of Trend-lines (see Sources). The Makita is a lightweight (37.5 lb.) saw with a 12-amp motor.

Pros and Cons of Benchtop Saws

The obvious advantages of benchtop table saws are their compact size and relatively light weight. Most weigh between 40 and 60 pounds, making them easily transportable by one person. A few tip the scales beyond the point of calling them truly portable, though (see chart on page 68).

They're usually called benchtop saws, but "sawhorse saws" might be a more accurate description, because the workbenches in most shops are too high to use them comfortably. I've mounted mine on a piece of plywood, which I clamp to a couple of sawhorses out in the back yard. Some woodworkers, such as my editor Dave Peters, have built stands that put the saw table at a comfortable working height. Dave tells me that the saw is still light enough so he can move it outdoors as needed. By sizing the table so his benchtop saw is at the same height as his stationary saw, Dave adds that with the two saws positioned back-to-back, each saw doubles as an outfeed table for the other. If you equip the stand with locking or retractable castors, you can easily roll it out of the way when not in use. Most manufacturers offer metal work stands or leg sets for their benchtop saws.

During my tests, I noticed that most of the saws are heavy enough that you needn't clamp or bolt them to the bench or other flat work surface when cutting relatively small pieces of stock. I wouldn't advise this practice, though: The owner's manuals tell you to mount the saw as a safety precaution, so who am I to argue? Besides, if you try to run large boards or panels through these saws while freestanding, they'll definitely take a walk. To retain the portability feature, mount the saw on a piece of 3/4 in. (or thicker) plywood (slightly larger than the base cabinet), and clamp it to the work surface with C-clamps. A square cutout in the plywood base keeps sawdust from piling up inside the saw.

Drawbacks — Many of these saws have a surprising amount of power for their size, but you still can't expect them to perform like a stationary table saw. Because they have smaller motors than most stationary models, they're less able to plow through heavy stock without bogging down. Also, their lighter-weight blade-carriage assemblies lack the precision and smooth operation of those found on most floor models. And, of course, on most of the saws, the smaller table size not only limits their rip capacity, but also provides less support for large boards or sheet goods. Two exceptions to this are the Makita 2711 and the Ryobi BT-3000, whose sliding rail systems actually yield greater rip capacity than many stationary saws.

Better Benchtops

Over the past few years, benchtop table saws have improved in many respects. Not long ago, the market seemed to be flooded with "under $150" models, most of which were being imported from overseas. The prices certainly appealed to budget-minded weekend warriors, but most of these saws were underpowered and lacked the overall sophistication and accuracy required for exacting work. In short, they didn't cut it with most woodworkers—hobbyist or professional. As a result, sales declined as tool returns increased, so most manufacturers and importers have either dropped these "toy table saws" or have redesigned their benchtop models to better meet customer expectations. Today, even the low-end saws are considerably better than their predecessors.

Apples and Oranges — The nine saws I reviewed range in price from under $140. to nearly $600. As you might guess, I found some differences in power, cutting precision, and overall quality. While you can't expect a low-end benchtop saw to perform like a high-end one, the price you can *afford* to pay for any tool is always a consideration. If most of your woodworking revolves around the table saw, buy the best you can afford—stationary or benchtop—even if it means skimping on the cost of other woodworking tools and equipment. If, on the other hand, you use a table saw only occasionally, or for smaller-scale projects, one of the less-expensive models will do.

Also take into account the type work you do on a table saw. For example, the sliding tables on the Ryobi BT-3000 and Makita 2711 make them double-duty saws for ripping *and* crosscutting stock, which could potentially eliminate the need for a radial-arm saw or power miter saw in your shop. They're also among the heaviest of the benchtop saws, so they're not quite as easy to pick up and

toss underneath the bench when you're through using them. By contrast, the Delta 8¼ in. Builder's Saw (model 34-330) is designed primarily for ripping "2-by" dimensional lumber and plywood panels on site. The Delta doesn't have the cutting depth of a 10 in. saw, nor the crosscut capabilities of the Makita or Ryobi, but it's an accurate, ruggedly built machine that packs a powerful punch in a lightweight (40 lb.) package.

Cutting Capacity

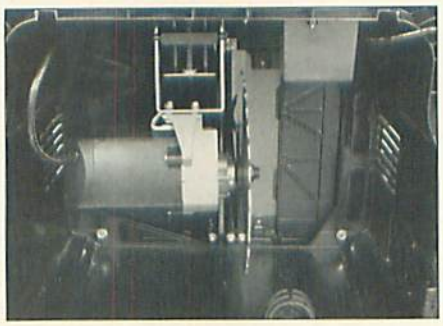
This refers to the maximum size of the stock you can cut on the saw. The two most important figures are maximum depth of cut (blade height above the table) and rip capacity (distance between rip fence and saw blade).

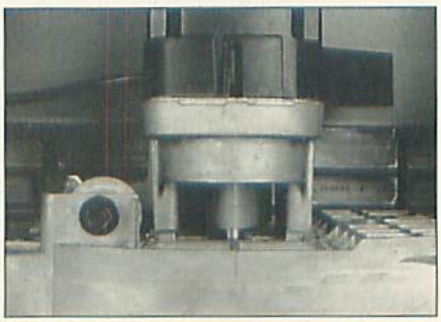
Rip Capacity — Most manufacturers list the maximum rip capacities on both the left and right side of the blade. On all saws except the Makita, you can install the fence on either side. Some offer optional extension tables (Delta, Skil, Ryobi BT-2500), or guide rails (Ryobi BT-3000) to increase rip capacity.

Depth of Cut — The chart on page 68 lists the specs for the maximum depth of cut at 90- and 45-degree blade positions. In order to rip or crosscut dimensional "4-by" lumber in one pass (without flipping the stock), you'll need a maximum cutting depth of at least 3 9/16 in., which only the Makita 2711 and two Ryobi saws have (see chart). But the depth-of-cut figures don't mean you can always achieve the full depth of cut in one pass—especially on some of the smaller saws. For deep cuts, it's best to make several passes, elevating the blade a bit each time, to avoid placing too much stress on the motor and the blade.

Table Size — A less-direct measurement of a saw's capacity is its table size. Larger tables provide better support for large boards and panels. Saws with larger tables also have longer rip fences, which translates into more accurate cuts and less chance of binding the sawblade in the cut. While it's possible to rip a 4 ft. by 8 ft. plywood panel or 10 ft. long board on even the smallest benchtop saw, cutting accuracy and user safety will be compromised. Again, table extensions (and other work supports) will help, but the smaller benchtop saws in our chart really aren't designed to cut the big stuff.

Perhaps more important than the overall size of the table is the amount of table space in front of the blade. The table must provide sufficient support for the stock when you first feed it into the blade. For this reason, manufacturer's specs often include the distance between the front edge of the table and leading





Photos 1 and 2: With the exception of the Ryobi BT-3000 with its belt drive (below), all benchtop saws have direct-drive motors, such as the Skil 3400 shown above.

edge of the blade (usually at a blade height of 1 in.) One last consideration: All of the saws accept stacked dado sets. The chart on page 68 gives specs for all of the above mentioned capacities.

Motors

Of course, you need to consider power when choosing any power tool. But you can't always determine how powerful a tool is by manufacturer's specifications alone. For example, a couple of manufacturers list the saw's *maximum developed horsepower*, but most don't assign horsepower ratings to their saws. All except the 8 in. Sears (model 22162) have universal-type motors, which are typically rated in amps only. But even amp figures can sometimes be misleading: For example, in my tests, I noticed that the Makita 2711 (rated at 12 amps) seemed to have more guts than most of the saws rated at 13 amps.

The story is a bit more complex than this, however, so I've covered the whole business of manufacturer's power ratings in a separate article on page 22. Interestingly, the Sears saw has a 7.2-amp induction (brushless) motor; a scaled-down version of the type commonly used for large stationary machines. Although of lower amperage than the universal motors on the other saws I tested, it performed satisfactorily in my "blade bog-down" tests. The motor is well-matched to the blade size, although not quite as powerful as the other saws tested.

On the 10 in. Sears, AMT, Skil, and Reliant, the 13-amp motors looked virtually identical, and I really didn't notice much difference in power between them—all were much gutsier than I expected, given the low prices of these tools. Several of these manufacturers concurred that they were buying the motors from the same source, which is typical with most stationary machinery. Power-wise, the 13.8-amp Ryobi BT-2500 has a bit more spunk than the 13-amp saws above: during the 2 years I've owned mine, I've run some stuff through it that I didn't think a benchtop saw would handle. The 8¼ in. Delta also had lots of power, but I suspect that's because the 13-amp motor (made by Porter-Cable) drives an 8¼ in. blade instead of a 10 in. one.

The two most powerful saws of the group are the Ryobi BT-3000 and the Makita 2711; they're also of better overall quality. For the price, though, you can expect them to be.

Drivetrains

All but the Ryobi BT-3000 are direct drive saws (Photos 1 and 2). On the 8 in. Sears saw, the blade arbor is an extension of the motor shaft; because induction motors run at a fixed speed (3,800 rpm), the blade speed equals motor speed. On direct-drive saws with universal motors (all the rest), the blade arbor is connected to the motor shaft by means of a single helical reduction gear inside the motor housing. The gear meshes with the splined end of the motor shaft, offsetting the arbor toward the top of the motor housing. This arrangement not only allows for a greater depth of cut, but also serves to reduce the high rpm of universal motors (from 14,000 to 18,000 rpm) down to a no-load speed suitable for sawing (3,800 to 4,800 rpm). Several of the saws have the same motors, but the gearing is slightly different, therefore

they run at slightly different no-load speeds (see chart).

The Ryobi BT-3000 has a unique belt-and-pulley drive to offset the arbor above the motor housing. In theory, anyway, the belt places less stress on the armature shaft, extending the life of the motor.

Quality Under the Table

More important than motor or drive type is the quality of the bearings and other motor/drive parts, as well as the precision of machining in the other undercarriage parts, such as the tilt and elevation mechanisms. Any slop in the motor shaft (arbor) or undercarriage parts will result in excessive vibration, inaccurate settings and blade runout (wobble), all of which affect performance. A look underneath the table tells the story. Tilt the blade at an angle between 0-45 degrees, then grasp the motor housing or blade carriage assembly and try to move it. Any slop here indicates play in the tilt/elevation mechanisms or flexing in the blade carriage brackets, both of which can contribute to inacurate cuts. Also shake and twist the blade lightly to check for slop or play in the saw arbor (the shaft the saw blade attaches to).

Tables and Base Cabinets

Because portability is a consideration with benchtop saws, most use lighter-gauge materials for parts than you can expect to find on the floor models.

Tables — All saws except the Delta and AMT saws have cast-aluminum tables. Cast-iron tables and other components are generally preferable on full-size table saws because they're less likely to warp or become damaged, but the lighter-weight cast aluminum tables make better sense on the small benchtop machines. Surprisingly, one of the least expensive saws, the AMT 4810 has a cast-iron table. While more durable than the tables on the other saws, it does add considerable weight to the unit for it's relatively small table size. The Delta, on the other hand, has a reinforced-polyester plastic table and optional table extensions. I did notice some minor flexing in the plastic table and extensions, although I noticed no warpage in them, and the flexing didn't appear to affect the cutting accuracy of the saw. By the way, before you buy any table saw (or accept delivery on a mail-order one), make sure the table has been milled perfectly flat. You can do this by placing a straightedge diagonally across the table in both directions. If the table is warped or otherwise damaged, either ask for a replacement table or another unit. None of the saws I tested had warped tables, but occasionally, one does slip by the manufacturer's quality-control department.

Also make sure the table extensions attach perfectly flush to the main table. On some of the early Ryobi BT-3000s, the sliding cutoff table was slightly higher than the main table. If you have one of these early units Ryobi will send you a retrofit kit at no charge to lower the sliding table to the proper height.

The two extension wings that come with the Sears saws will eventually align with the main table, but only after considerable fiddling around with the seven hex head machine screws used to attach each extension. (Over three pages in the assembly manual are devoted to showing you how to do it—a real exercise in patience!)

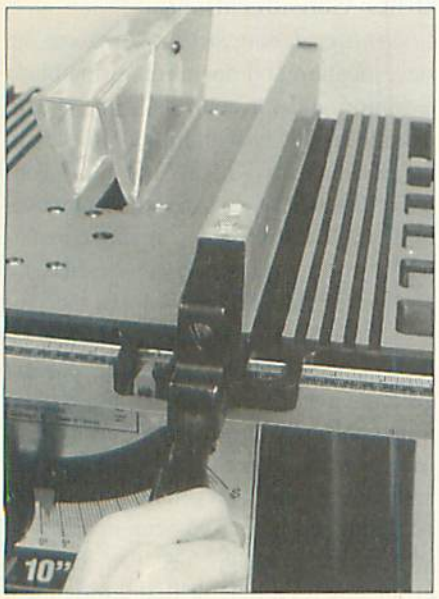


Photo 3: The accurate, self-locking fence on the Skil 3400 locks quickly with a pull-down lever–a feature I like.

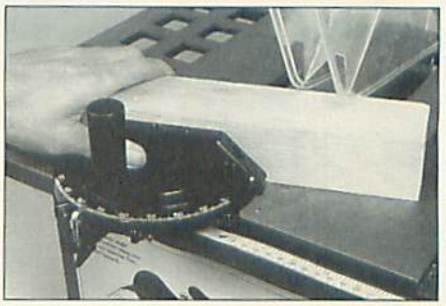


Photo 4: The AMT has one of the best miter gauges—large, sturdy, accurate, and easy to read, with adjustable stops. The gauge on the Skil is a close second.

Base Cabinets — Most of the saws have base cabinets made of light-gauge stamped steel. The Makita, Reliant, and Skil have thicker, but lighter, plastic bases. To me, the plastic bases seemed to be as durable as their steel counterparts—especially the one on the Reliant. I didn't drop the saws off the bench to find out, though. Also check the location of the mounting holes on the saw base. On the AMT, Delta, Ryobi BT-2500 and both Sears saws, the holes are inside the

Crosscutting Table Saws

The Ryobi BT-3000 and Makita 2711 stand apart from the rest of the bench-tops. Not only are they top-of-the-line machines in all respects, but both have sliding tables with bar-type miter fences that adjust 45-degrees in either direction (Photos 5 and 6). The sliding tables enable you to make precise crosscuts, miters and compound miters in wide or long stock. In my tests, both tables were highly accurate and easy to use.

While the Makita seemed a bit more powerful than the Ryobi, the latter is more sophisticated: The sliding table has four quick-release levers that enable you to mount it on either side of the blade. Mounted on the right side, you can use the crosscut table in conjunction with the accessory router/jigsaw table. Optional accessories for the Ryobi include router/jigsaw mounting kits, wide table kit, a 40 in. miter/rip fence, metal work stand, dado throat plate, miter clamp, and dust bag. Makita offers an optional metal work stand, dado throat plate and extension bars to increase rip capacity. Makita also has a nice feature the other saws don't: an electric brake that brings the blade to a quick halt as soon as you shut off the saw. Ryobi, on the other hand, has a highly efficient dust pickup system (see Dust Control).

Specifications Chart

Make	Model	Blade Dia. (in.)	No-Load Speed (rpm)	Motor Type[1]	Amps @ 120V	Motor Drive[2]	Rip Capacity (in.) Left	Right
AMT	4810	10	5,300	U	13	D	11	9 1/2
Delta	34–330	8 1/4	4,500	U	13	D	8 1/2	12
Makita[7]	2711	10	3,800	U	12	D	—	24
Reliant[8]	DD15	10	4,800	U	13	D	9 3/4	9 1/2
Ryobi[7]	BT-3000	10	4,800	U	13	B/P	14 1/2	24
Ryobi	BT-2500	10	4,500	U	13.8	D	9	12
Sears	22162	8	3,800	I	7.2	D	12 1/4	11 1/2
Sears	22172	10	5,000	U	13	D	13 1/4	15
Skil	3400	10	4,800	U	13	D	11	12

[1] U = universal; I = induction
[2] D = direct drive; B/P = belt & pulley
[3] Stacked dado set (slightly wider for wobble-type blades)
[4] Table in front of leading edge of blade @ 1 in. depth of cut
[5] S = standard; O = optional; N = none

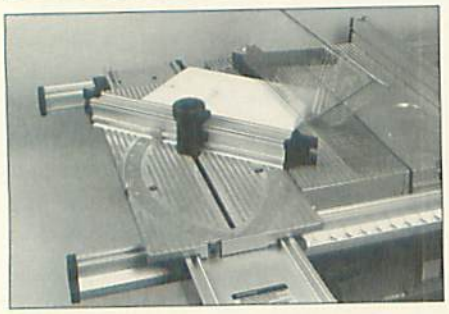


Photo 5: Sliding crosscut table on Ryobi BT-3000 can be mounted on either side of the blade.

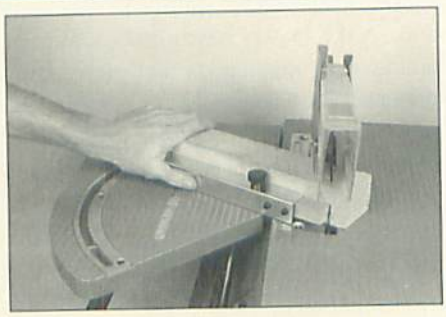


Photo 6: Makita's sliding table includes hardwood indexing insert to support stock right up to the blade.

cabinet, which makes it much harder to mount the saws on a bench, unless you make a plywood base for them, as discussed earlier.

Rip Fences

Because table saws are often used for ripping, you'll want a rip fence that's accurate and easy to set, even if the miter gauge isn't. The fences I found most accurate and easy to use were those with a single, pull-down lever that locks the fence both front and rear. Saws that have them include the Ryobi BT-3000, Makita, Delta and Skil. The Skil has an especially accurate, easy-to-set fence, given its low price (Photo 3). Also check how easy it is to read the rip scale on the fence guide bar. On most saws, the scale reads in inches and millimeters; the 8 in. Sears saw doesn't have a scale at all.

Miter Gauges

With the exception of the Ryobi BT-3000 and Makita 2711, with their sliding cutoff tables, the rest of the saws have conventional miter gauges with 60-degree left/right scales. I prefer saws with large, easy-to-read gauges. Larger gauges provide better support for the workpiece and are easier to set accurately. AMT, Delta and Skil earn big points here; I especially liked the adjustable miter stops on the AMT gauge (Photo 4).

Blade Guards

All of these saws have blade-guard assemblies that consist of a clear-plastic blade guard, splitter, and anti-kickback pauls. They're all pretty much the same in design and function, with this exception: The AMT, Reliant, Sears and Skil saws have externally mounted blade-guard assemblies, which are connected by a long rod to the blade carriage assembly. This enables the blade to be mounted farther toward the rear of the table, increasing table space in front of the blade. With these, however, I noticed that the splitter tended to move slightly out of alignment with the blade when tilted. On the rest of the saws, the blade-guard assembly mounts directly to the blade carriage behind the blade (you must remove the throat plate to install or adjust the guard/splitter position).

While you might consider these assemblies annoying, especially when making crosscuts and miter cuts, you should not remove the guard unless you need to cut dadoes or make cuts only part way through the stock thickness (the splitter prevents you from feeding the stock past the blade).

Other Considerations

Controls and Switches — Check out the size, location and operation of the blade elevation and tilt controls. They should operate smoothly with little or no slop in the mechanism. On all but the Ryobi BT-2500 and Sears saws, tilt and elevation are controlled by a single handwheel (or a twist knob on the Makita) and locking lever on the front of the saw.

All of the saws have a provision for locking the ON/OFF switch to prevent accidental startup (Photo 7). Most use a removable plastic switch insert (which usually tends to get lost); the Makita has a separate switch-lock button that must be depressed before you can operate the switch. The Delta has the simplest arrangement: a hole drilled through two projecting ears on either side of a toggle switch, through which you can insert a padlock (not provided).

Depth of Cut (in.) 90°	45°	Max. Dado Width (in.)[3]	Table Size (in.)	Blade to Front of Table (in.)[4]	Extension Table[5]	Net Weight (lbs.)	List Price[6]	Street Price[6]
2 7/8	2 1/2	1/2	17 x 26	6 1/8	N	63	$245.00	$219.00
2 1/4	1 3/4	13/16	20 x 26	9	O[10]	40	$301.00	$279.00
3 9/16	2 1/2	13/16	23 1/2 x 27 1/2[9]	10	S	71.6	$868.00	$480.00
3	2 1/2	1/2	16 x 26	6 3/4	N	40	$139.95	$139.95
3 9/16	2 1/2	13/16	22 1/4 x 25 1/2[9]	9	S[10]	75	$1,157.00	$570.00
3 9/16	2 1/2	13/16	18 29/32 x 27 9/16	6 7/8	O	39.6	$613.00	$359.00
1 3/4	1 1/16	9/16	17 x 30	9 3/16	S	37.5	$139.99	$139.99
2 1/2	2	1/2	19 1/8 x 37	10 1/2	S	52	$199.99	$199.99
3	2 1/2	1/2	17 5/8 x 26 5/8	8 1/2	O[10]	40	$199.00	$179.00

[6] List = Manufacturer's suggested retail price; Street = Actual catalog price or average retail price
[7] Saw uses sliding crosscut table instead of miter-gauge.
[8] Reliant sold by Trend-lines; see Sources.
[9] Dimensions of main table plus sliding table, without allowance for extra area obtained as a result of sliding table or rail adjustability.
[10] Extension rail kit increases rip capacity on Ryobi BT-3000 to 72 in.; Delta's extension tables expand rip capacity to 24 in.; Skil extension tables (mount both on right side) expand rip capacity to 28 in.

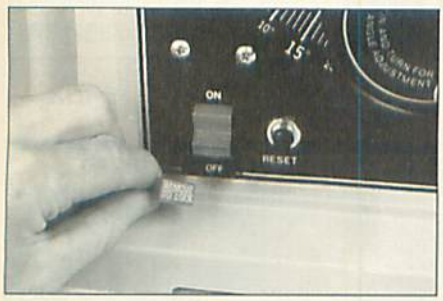


Photo 7: Removable switch on Reliant prevents unauthorized use or accidental startup; reset switch connects to circuit breaker that protects motor against overload.

Photo 8: Like its big brother, the table on the Ryobi BT-2500 has provision for mounting a router.

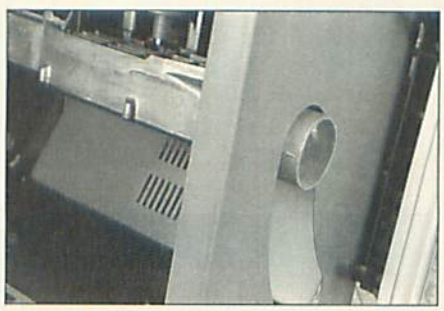


Photo 9: Dust port on Ryobi BT-3000 attaches to a blade shroud for efficient dust pickup; the BT-2500 and Skil are the only other saws with provision for dust control.

Extra Tool Mounting Provision — Although it seems like a good idea—especially in a shop where space is minimal—only the two Ryobi saws include provisions for mounting other tools to the table. The extension table on the Ryobi BT-3000 accepts either a router or jigsaw, while the table on the BT-2500 includes a cutout for a router mounting (Photo 8).

Dust Control — Surprisingly, only the two Ryobi saws and the Skil have dust collection ports. The Ryobi BT-2500 has a 1 1/4 in. port and hose attachment; the BT-3000 and Skil, 2 1/2 in. ports. A dust bag is optional for the BT-3000. It's surprising to me because benchtop saws are designed for small shops, and small shops ususally fill with sawdust faster than big ones (Photo 9).

Blades — Most of the saws come with cheap, stamped-steel blades. The Ryobi BT-3000 and Delta come with good quality thin-kerf carbide-tipped blades. Ryobi's is a chip-limiting (anti-kickback) type made by Freud. The first thing I'd do with the other saws is replace the steel blade with a thin-kerf carbide-tipped one. Perhaps more than any other feature, thin-kerf carbide blades are what make benchtop table saws practical. Because the blades cut a 30–40 percent thinner kerf than conventional carbide ones of the same tooth design, they require less power to run.

Sources

AMT
4th Ave & Spring St.
P.O. Box 70
Royersford, PA 19468
Tel. 1-800-383-2681

Delta
246 Alpha Dr.
Pittsburgh, PA 15238
Tel. 1-800-438-2486

Makita
14930 Northam St.
La Mirada, CA 90638-5753
Tel. (714) 522-8088

Reliant
Trend-lines
375 Beacham St.
Chelsea, MA 02150
Tel. 1-800-767-9999

Ryobi America Corp.
1424 Pearman Dairy Rd.
Anderson, SC 29625
Tel. 1-800-323-4615

Sears
Sears Tower
Chicago, IL 60684
Tel. 1-800-366-3000

Skil
4300 West Peterson Ave.
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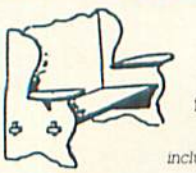

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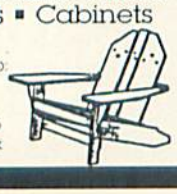

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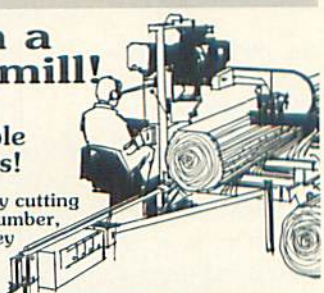

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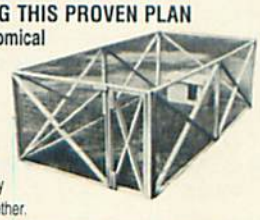

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shoulder on the tenon.

To socket the seat for the spindles, assemble the arms and back and set a bevel (Photo Q) to determine the angle. The spindles enter the bottom edge of the rail at a slight angle, so you'll need to trust your eye or set bevels to bore those sockets, too (Photo R). Trim the spindle tenons to fit the sockets either on the lathe or with a chisel.

Photo Q: Set a bevel to determine the angle of the spindle sockets in the seat; a piece of dowel extends the blade to the socket position on the rail.

Assembly

Before gluing up the base, cut a groove with a pocketknife along the length of each tenon to allow excess glue to escape during assembly. Wipe a little glue in the sockets and on the tenons and assemble the front legs and their stretcher, then the back legs and their stretcher. Add the two side stretchers, then insert the four leg tenons in the seat sockets, rapping the legs home with a mallet if necessary.

The joints should be tight enough that you can trim the legs to length right after assembly. I measure the front legs from the seat down and saw them off, holding the saw parallel to the seat bottom (Photo S). To mark the length of the back legs, I put the chair on the bench and hang the back legs over the edge, positioning the seat the proper height above the benchtop, as shown in Photo T. Cut one back leg, then rest three legs on the benchtop to check the mark on the last leg before sawing it.

Before assembling the back and arms, cut a saw kerf in the arm post and back post bottom tenons for wedges, aligning the kerfs at right angles to the grain of the seat. Assembly is a little tricky because of all those angles. First, I put the spindles in the seat, then assemble

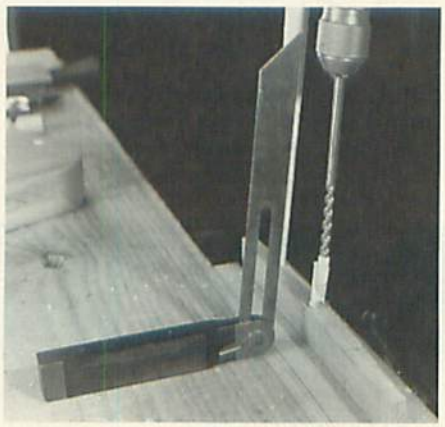
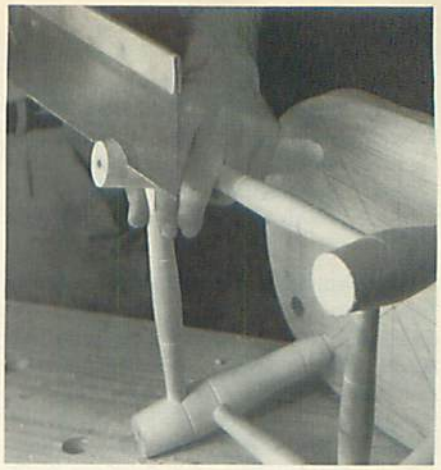
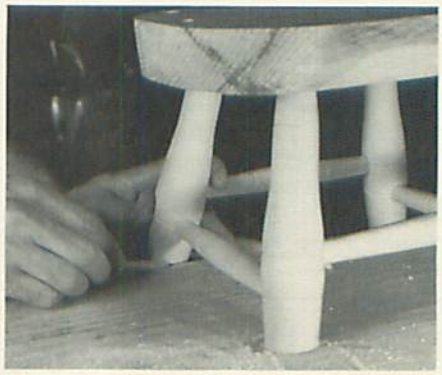


Photo R: Bore spindle holes in rail.

the arms, arm posts, back posts and rail, finally slipping them into place as a unit. It's always a good idea to dry assemble first, to see if everything works. Tap the wedges home to complete the assembly.





Photos S and T: Assemble the legs, stretchers and seat. Cut the front legs to length by measurement, then mark the length of the back legs using the benchtop as a straightedge.

Windsors were often painted. I like colorful chairs and have painted mine with traditional milk paint (from the Old-Fashioned Milk Paint Company, Box 222, Groton, MA 01450) or oil-based enamels in "colonial" colors. As much fun as it is making a child's chair, the best part is seeing it well used by a satisfied client. WWJ

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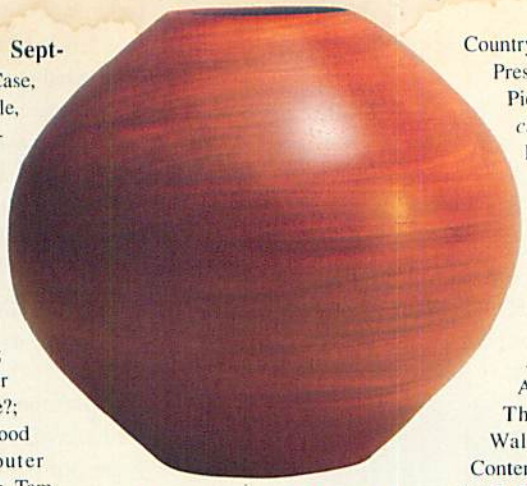

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Vol. 14 No. 3 May-June '90 Garden Table & Chair, Planter Box, Stackable Shoe Rack, Victorian Wall Shelf, Child's Stepped-Back Cupboard, Cat Push Toy, Tabletop Armoire, Shaker Tall Clock; *Articles:* Japanese Saws; Gluing Oily Woods; Tung Oil; Make a Tombstone

Boxes; Low-Tech Picture Frames: Use Simple Hand Tools for a Professional Job; Working with Gel Stains; Tool Review: Thin Kerf Blades.

Vol. 15 No. 5 Sept-Oct '91 Colonial Bench, Shop-Built Mortising/Tenoning Table, Pine Wall Cabinet, Gun/Bookcase/Curio Cabinet, Tilt-Action Dump Truck, Four Easy-to-Make Kitchen Projects: Cooling Rack, Salad Tongs, Serving Board, Recipe Box; *Articles:* Secret Compartments; Making Dadoes: Simple Joints for Simple Casework; The New Safe Strippers: How Well Do They Work?; Tool Review: Scroll Saws for Under $200.

Vol.15 No. 6 Nov-Dec '91 Country Pine Writing Desk, Hurricane Lamp, Little Folks' Desk & Bench, Classic Colonial Dollhouse, Keepsake Jewelrry Box, Father Christmas Carving, Hierloom Toy Chest, Plastic Bag Recycler, Faux-turned Vessels: 4 Full-size Patterns; *Articles:* Noise in the Shop; Faux-turned Vessels (technique); The Frame and Panel; Tool Review: The Bisquit Joiner.

Vol. 16 No. 1 Jan-Feb '92 Country Pine Mirror, Drop-leaf Dining Table, Chess Set, Shop Workcenter, Bandsawn Heart Box, Scroll-sawn Door Harp, Classic Firetruck, Toucan-on-a-Branch, Window Valance; *Articles:* Safer Router Bit Designs and New Accessories; Dutch Turning; Veneering; Tool Review: Plunge Routers; Special Section: Back Issue Index.

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Room Table, Chippendale Small Chest, Stacking Desk Trays, Pencil Box, Apple Doorstop, Space Shuttle Toy, Marquetry Coasters, Ice Chest with Marbleized Top, Globe Stand; *Articles:* Table Saw Basics; Cutting Full-Blind Dovetails; Marquetry:

Jewelry Chest May/June '89

The Pad Method; Marbleizing; Mount Lebanon Shaker Village: A Museum in the Making; Tool Review: Four Portable Planers.

Vol. 13 No. 6 Nov-Dec '89 Mission Style Trestle Table, Jewelry Box, Kids' Bobsled, St. Nicklaus Carving, Carousel Toy, Box Drum, Dancing Man Folk Toy, Towel Rack, Secretary Desk, Bed Tray; *Articles:* Mortising Butt Hinges; Dado Heads; Marquetry: The Empty Window Method; Aniline Dyes; Lynes Unlimited: Making Toys in a Kansas Chicken Coop.

Frame-and-Panel Door; Are Woodworkers Killing Our Rain Forests?

Vol. 14 No. 4 July-Aug '90 Slant-Back Cupboard, Folding Deck Table, Two Toy Dragsters, Colonial Sign, Barbecue Tray, Workbench Helper, Harvest Table, Plate Rack, Sunburst Mirror; *Articles:* Rasps; Safety: Workshop Finishes Pose Risks; Making the Dovetailed Wedge; Knock-Down Hardware.

Vol. 14 No. 5 Sept-Oct '90 TV/VCR Cabinet w/Pocket Doors, Shaker Woodbox, Cabinet with Punched Tin Doors, Sushi Set, Carved Pineapple, English Cutlery Tray, Toy Train Set, Workbench, Portable Tool Chest; *Articles:* Files and How to Use Them; Compound Angle Dovetails; Water-Based Finishes; Making the Slip Joint; Shop Test: 6 Dovetail Jigs.

Vol. 15 No. 1 Jan-Feb '90 Santa Fe Chair, Santa Fe Table, Clamp Rack, Provincial Bench, Step Stool, Box with Marquetry Top, Ash Wall Desk, Fork Lift Toy, Connecticut River Valley Highboy, Part 1; *Articles:* Tempering Steel Tools; Three Easy Finishes for Oak; Making a Cabriole Leg; Hand-Cut Dovetails; *Special Section:* Back Issue Index.

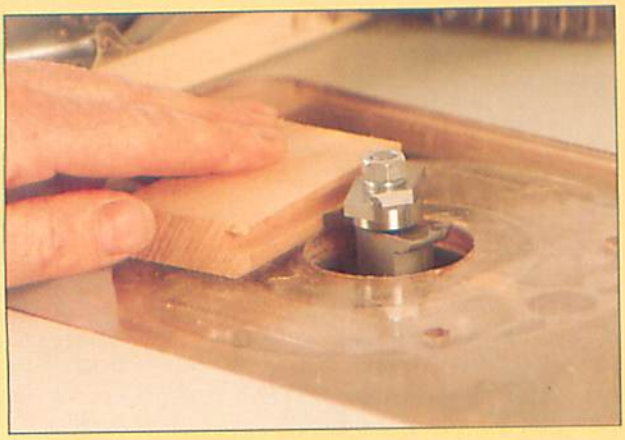
Vol. 15 No. 4 July-Aug '91 Mountain Dulcimer, Shaker Drop-Leaf Table, 4 Easy Picture Frames, Shop-Made Lathe Chuck, Napkin Holder, Fisherman Whirligig, Horse & Cart Toy, Gumball Machine; *Articles:* Shaping on a Table Saw; Turning Small

Vol. 16 No. 3 May-June '92 Cherry Lingerie Chest, Picnic Table, Butternut Breadbox, Tabletop Napkin Holder, Shoot-the-Moon Roller-ball Game, Intarsia Project, Drill Press Organizer, Country Curio Clock; *Articles:* Thinking Like a Craftsman; Collet Chuck Turning; Sharpening Guides & Gizmos; Finishing Kits.

Vol. 16 No. 4 Jul-Aug '92 Lawn Glider, Aeolian Harp, Candle Holders, Tractor/Trailer Toy, Audio/Video Remote Rack, Western-style Belt Buckle and Bolo Set, Side-by-side Chest/Cupboard, 3 Space-saving Projects for the Shop *Articles:* The Cordless Tool Revolution; Finishes for Maple; Joining Tops to Tables and Case Pieces.

Dump Truck Toy Sept/Oct '91

Next Issue . . .



Don't do your holiday shopping until you see our big upcoming November/December issue. It's packed with project ideas that make great gifts—like the **Toy Livestock Truck** and the easy-to-make scrollsawed **Nativity Scene**. And it features plans for one of our all-time favorite classic projects—the elegant **Governor Winthrop Desk**. But this issue also has a very special focus—getting the most from your router.

Included are plans for a versatile, **Shop-built Router Table**, a step-by-step article on using the router table to make door frames, and plans for a handsome little **Wall Cabinet** on which to practice your newly mastered door-making skills.

Add to this a **Tool Review** of the top-of-the-line scroll saws, a **Linenfold Carving** photo feature by master carvers Rick and Ellen Butz, plans for the ever-popular **Futon Bed**, plus three more project plans, and you'll know just why our big Christmas issue is always so eagerly awaited.